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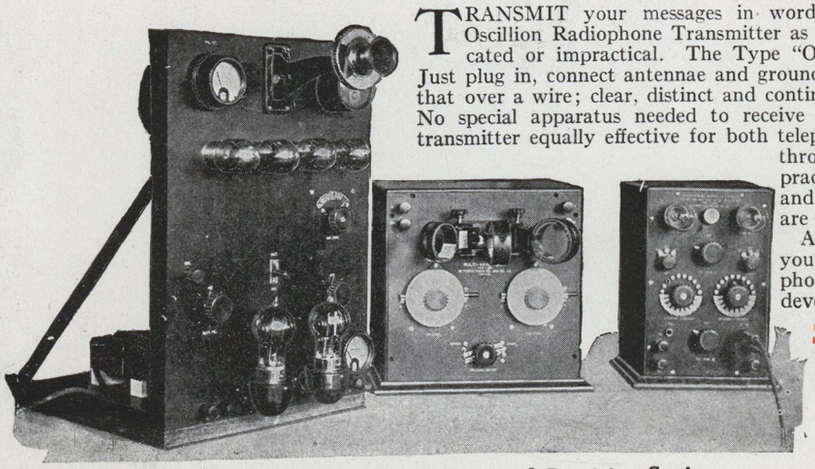

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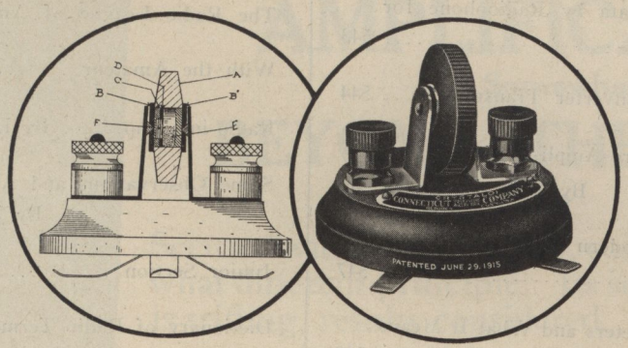

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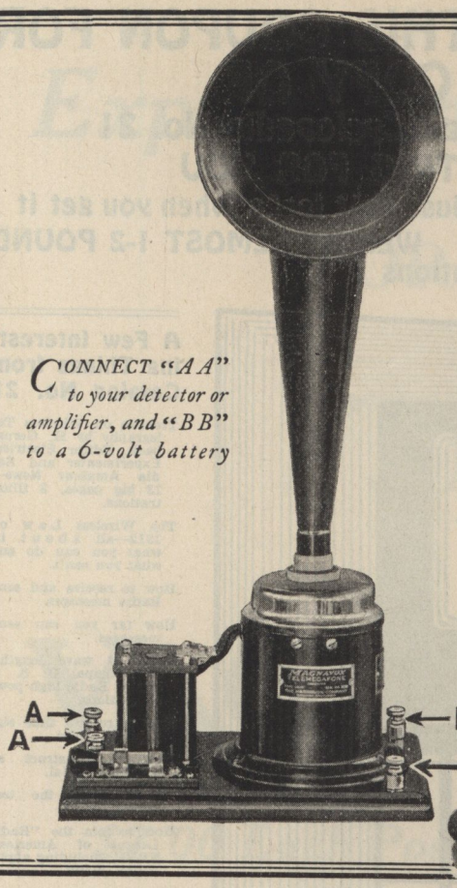

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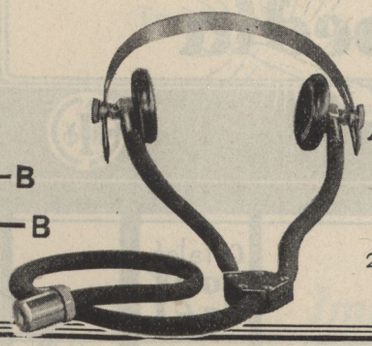

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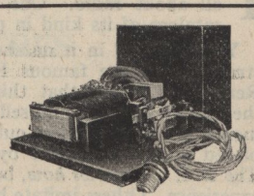

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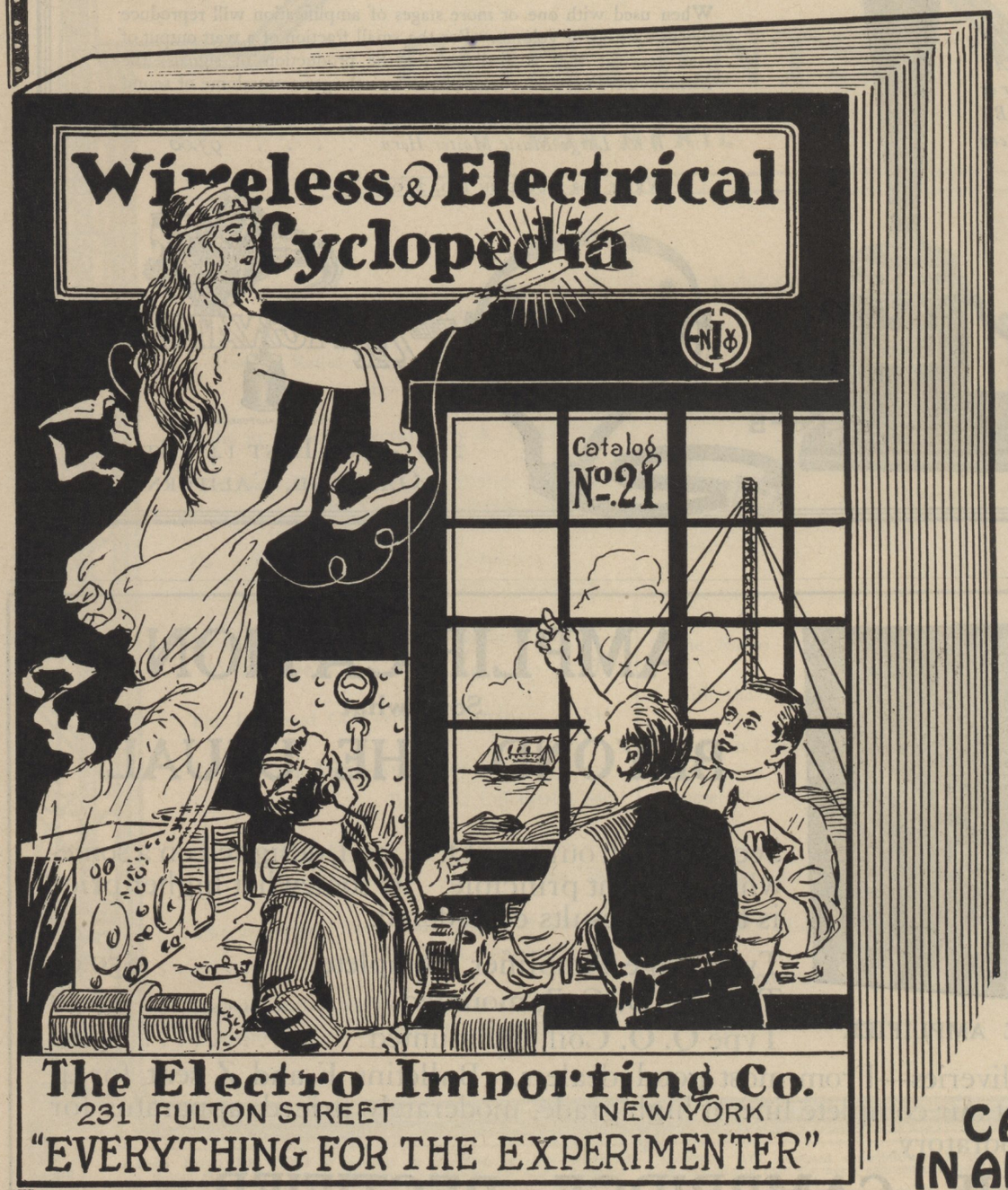

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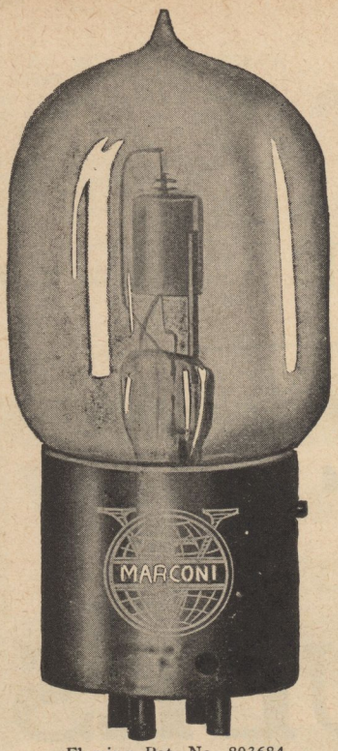

Fleming Pat. No. 803684
De Forest Pat. Nos. 841387-879532

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RADIO AMATEUR NEWS

H. GERNSBACK — EDITOR

Vol. 1. APRIL, 1920 No. 10

An Amazing Art

IF a future chronicler, let us say one hundred years hence, were to write up the progress of the various scientific arts, he would become very much bewildered in his endeavor to write an accurate history of the radio art as it blossomed in the good year Anno Domini 1920.

If he took recourse to the scientific literature and magazines of the prevailing period, his bewilderment would grow. Seemingly he would not find the slightest indication of just what instruments and apparatus were the best ones or the ones most commonly used in the dark ages of 1920. If he were to go back for a similar period, and were to try to chronicle the history of the electric telegraph and telephone, he would find no such difficulty. He would immediately find that even in the early stages, the telegraph and the telephone had been standardized at least for each prevailing country, and it would not be difficult for him to find out which telegraph and telephone instruments were the best ones or the standard type of the prevailing periods.

In radio telegraphy and telephony, he would find a very amazing state of affairs. Not only for the year 1920 but for any period since the beginning of the art. If he were to study the subject at all, he would for instance, find out that in the year 1920, the radio enthusiasts of that day were using many different forms of aerials. He would find aerials strung on top of the roofs, he would find aerials buried in the ground, and he would find aerials under water, as well as concentrated or loop aerials operated indoors. Our historian would have considerable trouble to find out just what aerial was the standard for the period of 1920 as well as which type was the most efficient. Most probably he could never solve the mystery.

Next, he would turn his attention toward detectors. Here he would find no doubt, that the vacuum tube led all the others, but that crystal detectors, electrolytic detectors and many others still were being used by the thousands. Surely, there should be one type as a standard or one type that was the best! But, our historian would not be able to find it.

The same would be the case with tuning coils, loose couplers, honeycomb coils and kindred instruments. Turning to sending instruments, he would find that we were using spark coils, transformer coils, arcs, transformers, vacuum tubes, and high power buzzers, all of these being used for transmitting purposes.

In looking back a few years before 1920, he would find all the amateur instruments scattered over the table, while two years later would find the same amateur with all his instruments enclosed in cases or mounted on panels.

In perusing the literature of this glorious period, our historian will no doubt come to the conclusion that the entire radio tribe of the time was either addle-brained or did not know its business, otherwise why have so many styles, so many different sorts of instrumuents, when one should be theoretically the best, and naturally should be adopted by the entire radio fraternity.

To our way of thinking today, such reasoning seems preposterous, but to the expert a hundred years hence, *our* reasoning will appear not only preposterous, but infantile.

And the moral of this editorial? It is simply this: the radio art of today is similar to the millinery business. Every season brings forth a new and very interesting crop of womans' hats in all sorts of different shapes, sizes, colors, etc., no attempt being made to standardize the woman's hat as for instance the man's hat. The result is that the average woman's hat costs three or four times as much as the man's hat, for the simple reason that no attempt has been made toward standardization.

We are certain that the next few years will see a great change of heart on the side of the manufacturers building radio instruments. They will find out that it does not pay to change styles and types overnight because, they themselves are the losers. Five out of ten radio manufacturers in the past have become insolvent for the simple reason that they had too many styles of the same instrument, when one or two would have sufficed. No manufacturer can put out a new instrument without expending several hundred or thousand dollars in tools, dies, parts, raw materials, etc. The minute he attempts to bring out too many styles he competes with himself, and invariably a great many thousand dollars expended in such tools, raw materials, etc., are left on his hands because the particular instrument will sell no longer and the tools and parts become worthless junk. If the manufacturer were getting a large price for his radio goods he could afford to stand the loss. In the millinery business for instance, a high price is charged and assessed on the hats that sell, and at the end of the season the few "stickers" that are left on the shelves can be sold at ridiculous prices because they already had been paid for in the good sellers.

In the radio business, this is not the case, and that is the main reason why the business is not healthy, why amateurs cannot get goods when they want them, and why so many radio concerns go out of business. If the average amateur could see the grave-yards of dis-continued radio apparatus parts in the average manufacturer's shop, he would appreciate the fact that a standardization of all radio apparatus is in order. As long as manufacturers persist in turning out too many styles and types, prices on radio instruments will be very high and will go much higher than they are now, and in the end the amateur must foot the bill. Besides the radio business in general will not be healthy. The blame, of course, does not lie with the amateur, but rather with the manufacturers. The amateur simply buys what is offered and shapes his idea from the various instruments that he sees offered for sale. In connection with this, it should be noted that the few manufacturers who prospered are almost exclusively those that do not make a wide and variegated line of radio apparatus, but are suppliers of a few well selected items on which they are constantly making improvements.

H. GERNSBACK.

A Modern Radio Telephone

Recent Low Power Records Made on Amateur Wavelengths

By ROBERT F. GOWEN*

WITH the advent of "C. W." or continuous wave telegraphy and vacuum tube radio telephony into the sphere of the amateur, this article is written to show its possibilities, and in an attempt to hasten the universal use of the vacuum tube transmitter and accordingly eliminate the tremendous interference existing on amateur wavelengths today.

The author, who though engaged in the profession of radio engineering at present, is still proud to call himself an amateur, has not forgotten the fascination of his apprenticeship days in amateur experimentation and operating, and trusts that what is presented herewith will be of value to the many thousands of amateurs of today who are looking for the best and foremost development in the radio art. The experiments described would have been absolutely worthless without the enthusiastic assistance and co-operation of the amateurs in general, and the author wishes to take this opportunity of expressing his sincere thanks to the many friends he has recently made "via Radio."

Last summer, because of the signing of the armisitce, the resumption of the manufacture of commercial apparatus made testing and demonstration to prospective customers a necessity once more. Before the war it had been practically impossible to accumulate much data on the transmitting ability of the oscillion apparatus because of the very unfortunate location of the laboratories at High Bridge, N. Y. The aerials are in the valley beside the Harlem River and are completely shut in by two large bridges, one of which is steel, considerably higher than the aerial tower.

As the prime requisite of radio telephone apparatus must be its definite working range, it therefore became imperative that the capabilities of the equipment be ascertained both as to range and durability. Therefore, the writer erected a 60-foot mast aerial at his residence in Ossining in order to provide a demonstrating and test station to work with the de Forest laboratories at High Bridge.

This comparatively small aerial consists of four wires on 12½-foot spreaders, 170 feet in length, strung between the two masts. A lead-in, about 60 feet in length, was taken off the house end of the antenna to form an inverted Γ with an average height of about 55 feet. At the first opportunity the electrical characteristics of the aerial were obtained, and it was found to have a capacitance of about 700 micro-micro farads and a fundamental wavelength of 355 meters. This aerial we felt was altogether too small for the contemplated transmitting set, but was the largest that could be erected under the circumstances.

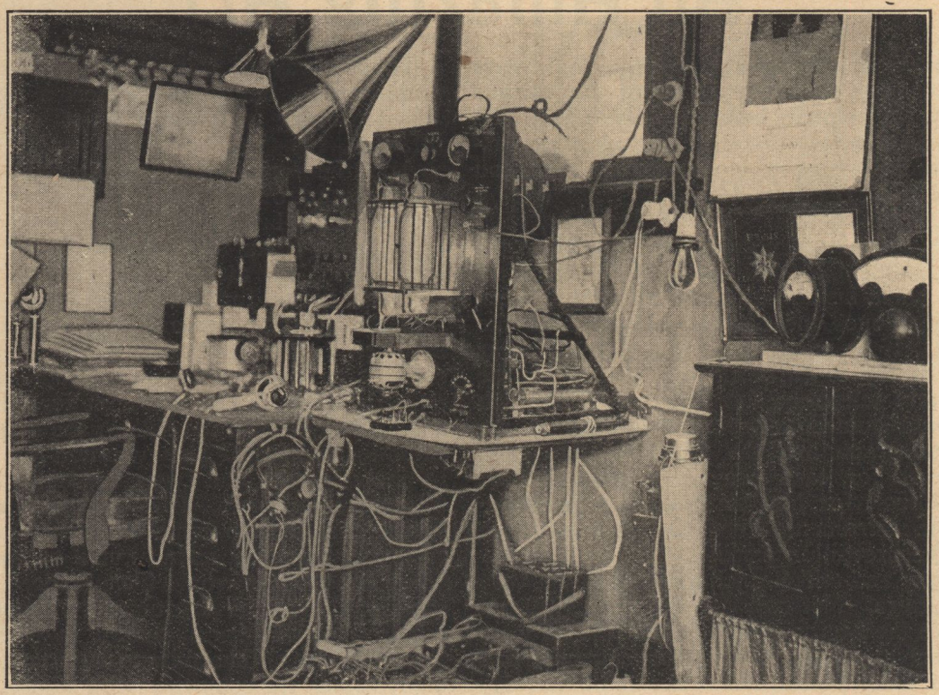


Fig. 5. Mr. Gowen's Radio Station at Ossining, N. Y., Call Letters 2XX, Where These Remarkable Telephone Experiments Were Conducted.

The ground connections had been previously put in place and consisted of 84 square feet of sheet copper directly beneath the foundations of the operating room connected to the transmitter with a heavy copper lead about 6 feet long. Additional grounds consisting of a copper lightning rod conductor to the water pipe on the street side of the meter, a lead to the gas pipe where it entered the house, a lead to an old cistern and a lead to a water pipe running into the garden directly beneath the aerial were also used. A special 110-volt A.C. power service from a separate transformer on the pole line in the street was installed for the purpose of driving the motor generator set and lighting the filaments of the oscillion tubes.

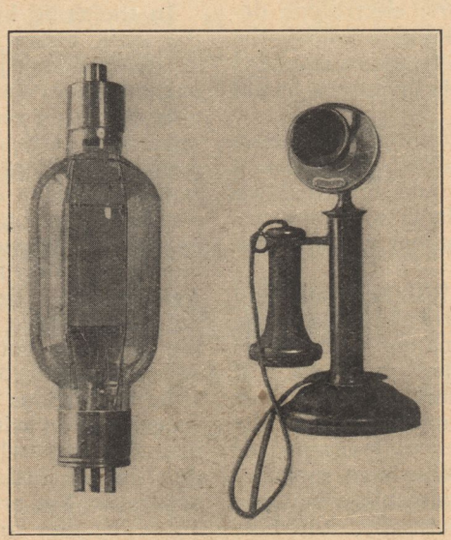


Fig. 3. Comparison of Size Between a 1 k.w. DeForest Oscillion Tube and an Ordinary Desk Telephone. Two of the ½ k.w. Type Were Used in the Experiments.

The transmitter consists of an improved type known as de Forest type O. T. 200 Oscillion Panel. It is similar to the standard one kilowatt sets previously turned out, the main difference being in the addition of a remote control relay switch and a new type of modulating circuit developed by Mr. C. V. Logwood.

It will be noted in the illustration (Fig. 1) that this transmitter uses two large ½ k. w. oscillion power tubes to produce the high frequency oscillating current in the aerial. The remote control relay is on the back of the panel together with the tuning helix and condenser, modulating coils, high and low frequency choke coils, filament resistances and filter condensers for the plate current. The microphone is shown on our front cover. It is of the type that is held in the hand and contains a push button or lever switch in the handle which operates the remote control relay connected to the microphone battery. This relay opens and closes electrically the plate and grid-leak circuits and switches the aerial from the transmitting to the receiving set so that practically simultaneous transmission and reception is accomplisht by pressing the button on the microphone handle when talking and releasing it when listening.

There is also a mechanical switch mounted on the face of the panel so that the relay may be operated without the use of the battery for telegraphing. On the left will be seen a wave-changer switch which is arranged so that any of three predetermined wavelengths may be used as desired. The plate coupling switch at the top of the panel is for changing the amount of inductance in the plate circuit to control the oscillating ability of power consumption of the equipment. It also has some influence upon the modulation. The fan shown below the tubes was used for cooling, since at the time this equipment was designed the old style tubes with nickel plates which required external cooling were still being manufactured. Since then the tubes have been greatly developed and a self-cooling type is now being used so that

*Engineer DeForest Radio Tel. & Tel. Co.

the fan has been done away with and the present equipments have no moving parts whatever.

The power plant as shown in Fig. 1 consisted of a 2 h.p. 110-volt single-phace A.C. repulsion motor directly connected to a 1 k.w. compound wound generator with field regulation for voltages between 900 and 1,500.

A chopper to be inserted in the ground lead and controlled by a switch on the face of the panel was mounted on a shaft of the motor-generator set so that a dampt wave could be transmitted for crystal detector reception. This has since been done away with as it has been found that modulation by means of a buzzer in the talking circuit is more practical.

Fig. 3 shows the type of oscillion tube used. A 1 k.w. tube, however, is shown in the photograph. Some idea of its size may be obtained by comparing it with the standard telephone desk set placed beside it. The ½ k.w. oscillions employed in the transmitter with which the tests were made are identical with the 1 k.w. tube in design but somewhat smaller in size, their overall length being 11½ inches. The telephone desk stand is 12 inches high. In these tubes the plates are suspended by means of rods in a frame campt about the stem at one end and supported by a ring at the other so that there is plenty of chance for expansion. The grid is supported similarly in a framework and the filaments are held in place by means of a quartz glass cross-bar which may be seen near the end of the tube. The plates are of tungsten and will therefore stand a very heavy bombardment without overheating. The glass is Pyrex which will also stand a comparatively large amount of heat, so that it is perfectly practical to run the tubes red hot without danger. Note the mechanically rigid construction which permits of the tube being shipt readily.

A typical deForest single tube transmitting circuit is shown in the diagram, Fig. 4. It will be noted that the plate is connected directly to the aerial end of the helix, the grid to the lower end and the filament to the ground. The arrangement gives a flexible circuit which is particularly valuable in commercial work. The grid-leak is inserted between the grid and filament in order to keep the potential of the grid positive to the extent that it will not block and cause the system to cease oscillating. The usual electromagnetic coupling between the grid and plate circuits is here replaced by a static coupling thru the aerial condenser. The secondary of the modulating transformer is inserted in the grid-leak circuit, the primary of which contains the microphone and talking battery. A telegraph key is also connected in the grid leak circuit and is shunted by a small resistance and condenser so that when the key is open, the tube will not become completely paralyzed and will continue functioning upon pressing the key.

Briefly the operation of the circuit is that by either pressing the key or talking into the microphone the potential on the grid is changed so as to modulate the output current or carrier wave emitted by the aerial. When using two tubes with Mr. Logwood's new modulating circuit the action is somewhat different, since both the plate and grid circuits are modulated by the microphone at the same time. This circuit possesses many advantages, the primary one of which is that both tubes are *used as oscillators as well as modulators*, and it is not necessary to have a special modulator for each oscillator as is the case with Mr. Heising's well-known and excellent absorption circuit.

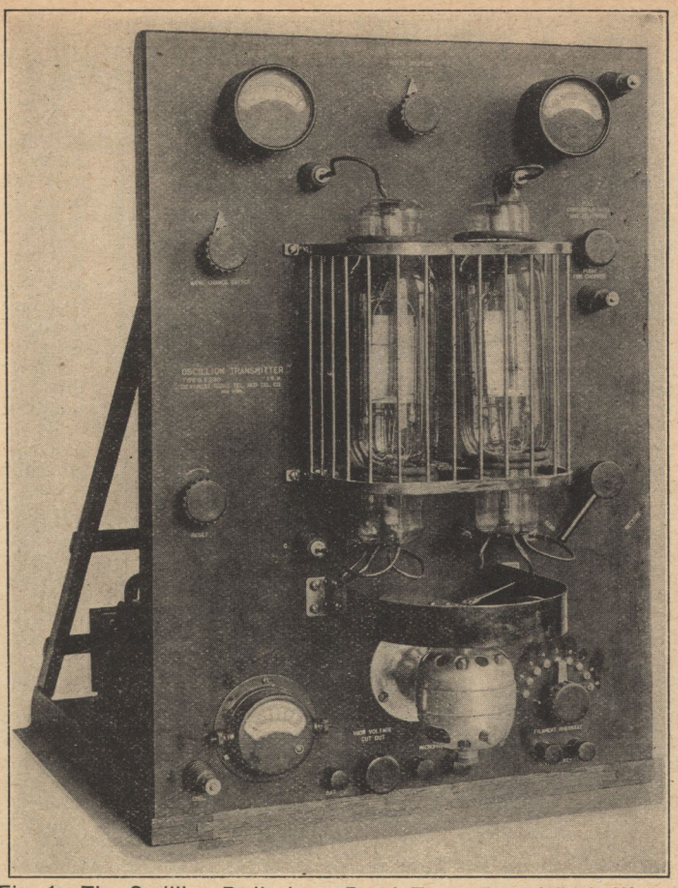


Fig. 1. The Oscillion Radiophone Panel Transmitter Which Was Made to Talk 1,500 Miles on One-half Power.

The receiving set shown in the photograph of the Ossining station (Fig. 5) was of the home-made type and consisted of a Honeycomb Coil tuner with Vernier type variable tuning condensers connected to the Audion Control Panel mounted directly above the latter. This panel contained a detector and a 2-stage amplifier. The standard deForest-Marconi V. T. Audions were used. Besides several pairs of head telephone receivers, the receiving set included the "Loud Speaker," made of a Baldwin receiver and an old phonograph horn, shown above the audion control panel.

The transmitting set was installed at the right of the receiver as shown in the photograph. The continuous wave telegraph key and starting switch were located at the operator's right. Later another key for modulated wave telegraphy was placed beside them.

The first problem which presented itself was that of induction from the alternating current house lighting circuit. This was so bad when the motor-generator set was running that sometimes it was impossible to hear High Bridge clearly. Several weeks were spent changing the circuit and putting in BX cable and conduit until finally the induction disappeared to the extent that it was no longer objectionable. In adjusting the set to transmit on 750 meters (the wavelength at that time assigned to our use by the Navy), there was no great difficulty, altho the amount of radiation obtained was a great disappointment. It was found practically impossible to get more than 3 amperes into the aerial, whereas at High Bridge, Mr. Logwood with a duplicate set had no difficulty in putting 7 amperes into the larger ship type aerial used there. It took some time and a lot of experimental work to get the set talking thru the steel of Washington Bridge so that Mr. Logwood could receive the writer without difficulty. Finally this problem was overcome and since that time we have had no difficulty in demonstrating the equipment.

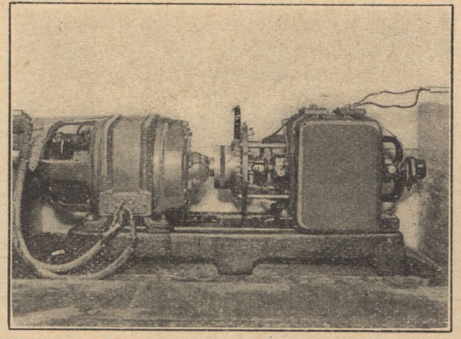


Fig. 2. The Motor Generator Set Which Furnished the 1,500 Volts Plate Current Potential for the Radiophone Transmitter.

An independent investigation in the writer's spare time was then started to see what the set would do in distance. It was necessary to work on short wavelengths in order that the amateurs, who are restricted to 200 meters or less, might pick up the signals with their receiving sets. With this arose new problems in making the transmitter oscillate at very high frequencies on these short wavelengths. Burning the filaments on the alternating house lighting current, one leg of which is grounded, caused a great deal of trouble at first, as it made the transmitter very unstable when oscillating at this high frequency. This difficulty was finally overcome by using a step down transformer in insulating the filament from the earth.

A separate low voltage generator for lighting the filaments is now supplied with all equipments to prevent a recurrence of this difficulty and to prevent trouble due to a voltage surge in the event of sudden ground on one leg of a 3 wire system should the set be connected to one.

Working on such short wavelengths meant adjusting and readjusting and changing the constants of the circuit until it was finally made to oscillate at 330 meters, a wavelength which is less than the fundamental of the aerial. As this meant of course that the set was working in a very inefficient condition, it began to look as if it would be impossible to work stations more than 25 to 50 miles away, especially since amateurs seldom listen for wave above 250 meters.

As it had been necessary to move the motor-generator because of the induction to a place in the cellar some 30 feet away from the set, the chopper was cut out and a buzzer and key inserted in place of the microphone for dampt wave telegraphy. During December, nearby amateurs were called and reports on the buzzer signals were obtained. Afterwards speech was transmitted to them by switching on the microphone and also music by putting the microphone in front of a phonograph. Up to January 1 a few reports from nearby stations were received, the farthest coming from West Point and Wallkill, N. Y., a distance of about 35 miles.

Then one night, about January 1, while working Mr. Decker, of Poughkeepsie, he reported that Mr. Benas, of Utica, had telegraphed him that he had heard the speech of Utica. The writer therefore

called Utica and was very much surprised to get an answer, and a few days later to receive a letter from Mr. Benas stating that on two occasions they had been *dancing there to the music of the phonograph.* These tests with Utica were continued for several days when one night Radio Station 8 E. R. was heard working some other station. His answering a call on the buzzer was a surprise, as the writer had not the least idea who 8 E. R. was. Further inquiry by means of the buzzer and by speaking into the microphone brought back the reply that 8 E. R. was getting the speech clearly, that the voice was very loud, that he was Mr. Candler at St. Mary's, Ohio, and last, but by no means least, that *he was more than* 600 *miles away.*

A day or two afterwards a letter came from him from which the following is quoted:

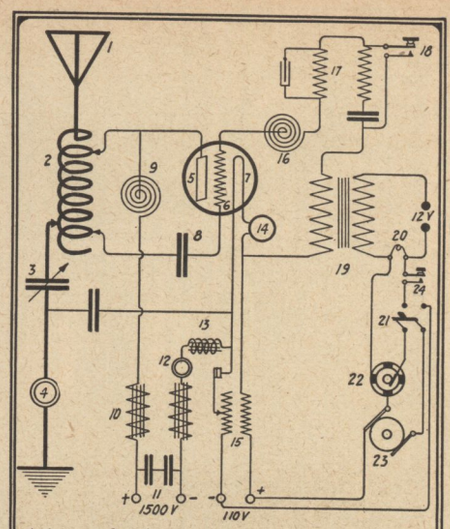
"Sunday morning, January 4, at about 12:40 we heard a station with a peculiar note calling us (8 E. R.) just after we had finisht working with a station. I immediately answered your call and nearly tumbled over when you commenced to talk to us by voice. The first time you started to talk it was difficult to understand you owing to the terrifice interference from strong stations in our locality. The next time (I think you called this No. 1) your voice came in loud and clear and we could easily understand a large part of what you said. Please bear in mind that QRM was had all the time and that we got you in spite of it. I do not remember all I got but recall that you said in part:

"'This is Ossining, N. Y. Ossining, N. Y.—Sing Sing—Get it?' When you started to speak again we could have easily understood every word you spoke had it not been for QRM from a strong station near here. Considering the distance covered and the extremely bad QRM that we had to work thru I consider the results obtained as wonderful, indeed."

The surprising part of it was that Mr. Candler at St. Mary's was using but a one-step amplifier with a straight audion detector connection without regenerative amplification.

At this time about 285 watts input was being used. This is just slightly more, it will be realized, than the amount of current used by the ordinary electric flat-iron with which we are all familiar. The aerial current was 2.2 amperes. Subsequent letters showed that the speech was heard at Columbia City, Ind., and Wakefield, Mass., at the same time. Columbia City reported that the speech was four times as plain as that over a city telephone line; that it was so loud he jumped in his chair when he "pickt" it up, that he understood practically all of it, altho there was considerable interference, and that the voice inflections were very pronounced. Mr. Reid, of Wakefield, Mass., reported that the buzzer was very loud, but the voice not plain. Some music also was transmitted to Mr. Candler that night which he received clearly and loudly and which Columbia City reported to sound like music coming from a phonograph with a bad needle. It so happened that this is exactly what it was, as the phonograph being used cost about five or ten dollars several years ago and has not improved with age.

Working with St. Mary's was continued nightly and many reports were received. Subsequently Mr. Benas at Utica, 175 miles away, said that the music could be heard 50 to 100 feet from the telephone receivers by using a two-step amplifier and that the buzzer signals could be heard all over the house. Mr. Ball at Hubbard, Ohio, reported the signals fine and strong and the music best which



1- Antenna. 2- Antenna tuning inductance. 3- A.T. condenser 4- Antenna radiation meter. 5- Plate. 6- Grid. 7- Filament 8- Grid cond. 9- Plate choke coil. 10- Plate filter coils 11- Plate filter cond. 12- Plate current meter. 13- Circuit brkr. 14- Filament ammeter. 15- Filament res. 16- Grid leak choke coil. 17- Grid leak res. 18- Teleg. key. 19- Transf. 20- Microphone. 21- copper sw. 22- chopper. 23 = chopper motor 24 - chopper key

Fig. 4. A Typical DeForest Tube Transmitting Circuit.

was rather an inconsistent condition.

On January 13 the speech was heard at Napanee, Ontario, a distance of 750 miles, and Mr. H. C. Wheat, of Gaffney, S. C., about 600 miles away, reported it as clear as a line telephone. Mr. Wilcox at Angola, Ind., reported the voice clear, the buzzer very loud and the music weak. A surprising letter was received from Mr. O. H. Bonter stating that he was getting the music clearly thru very bad interference but that the voice was nasal. He wrote in part as follows:

"I have been hearing you down here in West Palm Beach, Fla., 300 miles south of Jacksonville. I am located on a private yacht, 'Golden Anchor.' My aerial is very small—30 feet long, 10 feet back to lead-in, five wires 19 feet above water. I am using a regenerative set of my own make having one bulb. Have been hearing you regularly when weather is at all favorable—January 21, 22 and 25. Last night heard you from about 8 till 12 P. M. talking, singing, playing, one time calling 5 F L distinctly with voice."

Mr. Bonter wired back to Ossining on the morning of February 12 the exact words that were sent out to him the night previous at 11:30 P. M.: "QST to all stations west of Chicago, Cleveland, Ohio and yacht 'Golden Anchor,' West Palm Beach, Fla., 3 FM USS Seminole, and all other stations interested. Please report. Signed 2XG. Received C. W. loud and distinctly, thru heavy static. Yacht 'Golden Anchor.'"

Subsequently while working with Mr. Candler at St. Mary's, Ohio, as well as with Mrs. Candler who is also an expert operator and enjoys the distinction of being the only woman operator handling regular amateur traffic, the Rev. A. J. Manning at Salem, Ohio, was pickt up and reported both by telegraph and by letter, the voice fine, that he understood every word said and even went so far as to state that a listening friend with him remarked that the speaker must be Irish since he had an Irish voice.

Under date of January 27, Mr. Matthews, Chief Engineer of the Chicago Radio Laboratory, wrote the author as follows:

"I am giving you herewith a report of our work last night as requested by you on the Radiophone.

"We had been hearing you all evening while you were working with 8 E. R. and other stations and had called you several times prior to our getting into communication. We heard you call us at first on the phone and at that time were able to read every word said at a distance of over ten feet from the phones. We heard you call us on the modulated wave, and answered you the second time, at which time you apparently heard us. We were hearing you at all times at a distance of over ten feet from the phones, this audibility applying to both voice and the modulated wave, altho the buzzer was, of course, considerably louder than the voice. We were at first able to understand every word said by the voice, but as our work continued, the static began to increase and toward the end of our test it was rather difficult to understand what was being said, altho the buzzer was still coming thru in good shape. We noticed absolutely no fading of your signals thruout the test and were able to understand you thru a large amount of spark interference. Your wave is approximately 300 meters and is extremely sharp."

Fig. 7 is a picture of Mr. Matthews' excellent station in Chicago. This station has been particularly instrumental in lining up the Western stations for the most recent tests.

On January 29, Hamby, the murderer, was electrocuted at Sing Sing Prison, a distance of about a mile from the writer's home. Knowing Dr. Amos O. Squire, prison physician, very well, the author took the liberty of obtaining from the doctor the account of the electrocution immediately thereafter by telephone and broadcasted it by radio telephone and by telegraph about a half hour after Hamby expired. The broadcast was as follows: "Hamby, notorious murderer, electrocuted here at Sing Sing Prison tonight. Dr. Amos O. Squire, prison physician, pronounced him dead at 11:13 P. M. He went to the chair calmly smoking a cigarette and made a few remarks just before the current was turned on. He was very cool to the end." The newspapers printed this: "He was very cold to the end."

Subsequently Father Manning at Salem, Ohio, reported that he had received every word of it and forwarded a recent clipping from the "Salem News" confirming the whole statement.

The author could quote from many more such letters but space does not permit and they are more or less enthusiastic repetitions of those just mentioned. There are, however, some instances where the reports, besides being intensely interesting, are amusing as well. For instance, one night while working with Mr. Candler at St. Mary's, Ohio, he re-

(*Continued on page* 570)

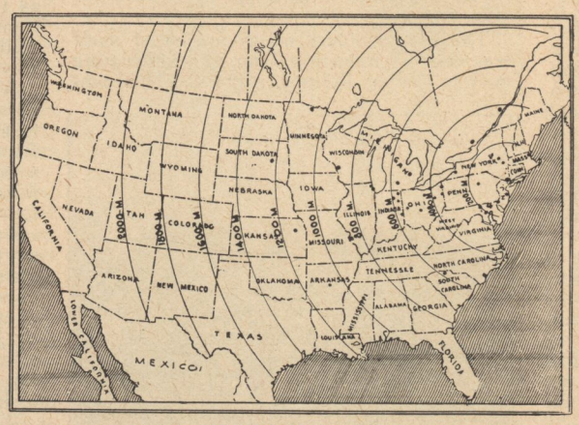


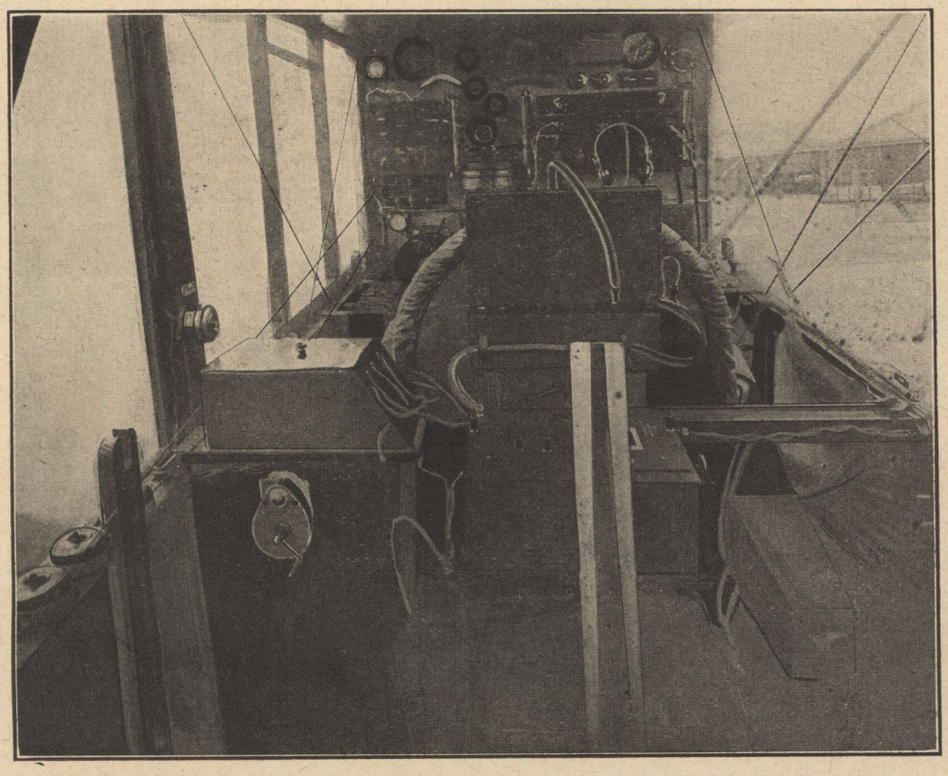
Fig. 6. Map of the United States Showing the Location of Amateur Stations Which Reported the Reception of the Speech From Ossining, N. Y. As Mentioned by the Author, the Circles Are Slightly Inaccurate.

Radio In Modern Aircraft

By ALEXIS J. HALL, A. M., I. R. E.*

THE accompanying photograph shows the radio equipment of the "Seabird," a high performance machine designed by Mr. J. A. Peters of the Alliance Aeroplane Co. of London. Had it been possible to get one of these machines ready in time, Mr. Peters was to have flown it in the "Daily Mail" Trans-Atlantic Flight, and it was expected that the journey from Newfoundland to Ireland would be made in about 12 hours. Since, however, the trial flights had not been completed when the Atlantic was actually flown, several long flights were made to gain experience of the type, and test the wireless equipment.

Later this type of machine was adopted by Messrs. Waring & Gillow, Ltd., for their Intercommunication Services between their various houses in London, Paris, Brussels, Madrid, Buenos Aires, etc. To inaugurate this service the first flight was made by Mr. Peters from London to Madrid on July 31st last—a distance of 900 miles in the remarkable time of 7¾ hours. This is the first and so far the only non-stop flight between London and Madrid and is the longest *commercial* flight on record.



In the Forward Compartment of the "Seabird" May Be Seen the Radio Installation Which is Mounted On the Dashboard in the Navigator's Cockpit.

On this trip were carried a letter from H. R. H. Princess Beatrice to her illustrious daughter H. M. the Queen of Spain and a gold cup which Her Majesty graciously accepted as a souvenir of the first commercial aeroplane flight from England to Spain, together with urgent and important communications and samples to Mr. Merry del Val, head of the Spanish House of Messrs. Waring & Gillow, Ltd. Copies of the "Daily Express" of that morning's issue were delivered in Madrid by 4 p. m. (English papers normally arrive in Madrid five days old.)

During the flight signals were received at intervals from the machine at the radio station of the Aerodrome, the company thus being kept fully informed of the machine's whereabouts and progress. Bearings were taken on the High Power Station at Aranjuez, near Madrid (E. G. C.), which was visited by the aviators during their sojourn in Madrid.

The radio installation is mounted on the dashboard in the navigator's cockpit and comprises:

1. (a) "Valve" transmission on Tonic Train and Continuous Wave.
   (b) "Spark" transmission.
2. Reception for both dampt and undampt waves between the limits of 400 and 4,000 metres.
3. Direction Finding Installation enabling aeroplane bearings to be taken on any station, the exact location of which is known, operating on any wave length, dampt or undampt, between the limits of 2,500 and 14,000 meters.

The detailed technical description is as follows:

For the transmission of "Tonic Train" signals, power is derived from a small self-exciting alternator, driven by a "windmill, giving 15 amperes at 10 volts with a frequency of 500 cycles per second. This energy is led into a transformer and stept up to 5,000 volts at which potential it is supplied to the valve.

The aerial coil has a certain number of turns forming the "primary coil" of the reaction scheme, the remainder being coupled in the form of a variometer. Three amperes can be radiated by an aerial 400 feet in length trailing from the machine.

The "Spark" equipment consists of a 150 watt induction coil operating on a novel kind of "make and break" system. This takes the form of a wheel, having 12 insulated segments spaced equidistant around the periphery rotated at 4,000 revolutions per minute, an interruption frequency of 800 breaks per second being thus obtained. The primary circuit is also tuned to this frequency which results in a very heavy secondary discharge, fed into the usual condenser-inductance circuit. A hot wire ammeter reading from 0-4 amperes completes the sending equipment.

The receiver comprises a triple valve cascade, the first valve oscillating and the other two amplifying the resultant audio frequency currents. A variometer reaction coil is also fitted providing radio frequency amplification. Signals have been heard on this receiver by the writer up to 1,000 miles, while flying.

DIRECTION FINDING

This equipment comprises a seven valve amplifier, "aerial" consisting of insulated wire sewn into banding and formed inside the planes and slotting in the struts of the machine, a switch box containing condensers for tuning the "band" aerial and a switch to determine deviation from the course desired. A self heterodyne set is also installed to enable bearings to be taken on arc or undampt stations.

The amplifier, which can be seen in the photograph with the phones plugged in is equipt with *seven valves*, three providing radio frequency magnification, one rectifying and three for audio frequency amplification. It is extremely sensitive.

A switching scheme is fitted by means of which the "auxiliary" aerial coil, which is arranged transverse to the fore and aft line of the machine, is either inserted in magnetic phase or opposition with respect to the main aerial coil.

In practise a listening-in watch is kept on the "main" coil which consists of 16 turns of rubber covered flexible wire laid flat, sewn up and inserted in a slot on the inner struts and formed inside the planes, the "auxiliary" coil, 8 turns of the same pattern wire, being entirely disconnected during this operation. Compensation is, however, made for the inductance of this coil by a small variometer in the "Tuner Box" which is set to the critical inductance valve of the auxiliary coil when same is installed in the machine.

As soon as the station is heard, a switch is thrown which cuts out the compensating variometer and inserts the auxiliary coil in circuit. Another switch marked (1) "louder, turn port" and (2) "louder, turn starboard" is operated, meaning, that if louder signals are heard from the station when in position No. 1 than when in position No. 2, the machine must be turned a few degrees to port. When the line of flight is in the direction of the sending station, either dead ahead or dead astern, the signal strength will be constant on either position of the switch.

A deviation of only one degree from the

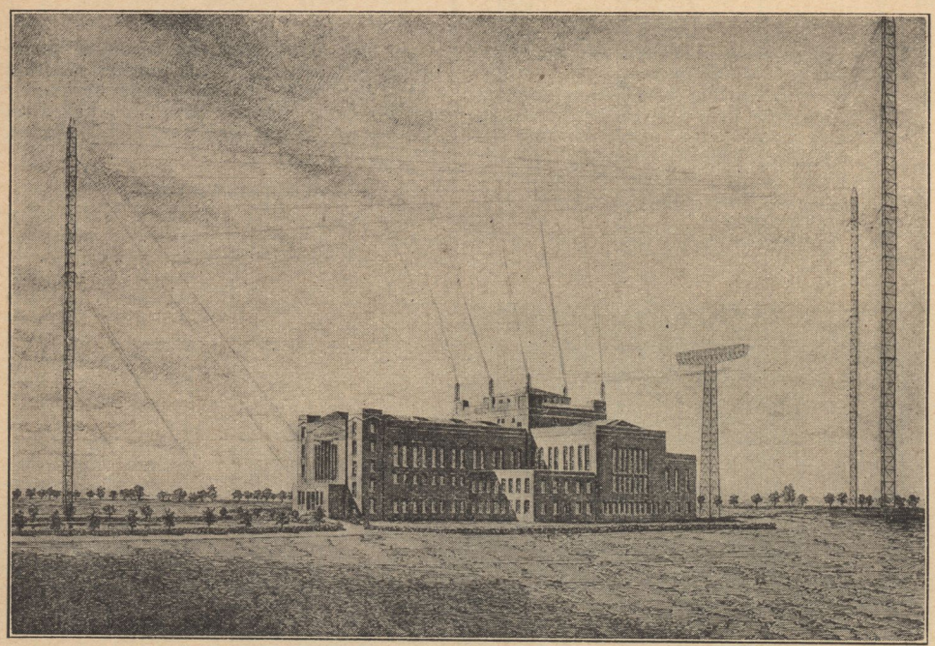
(*Continued on page* 578)

*Radio Engineer, Alliance Aeroplane Co., Ltd., London.

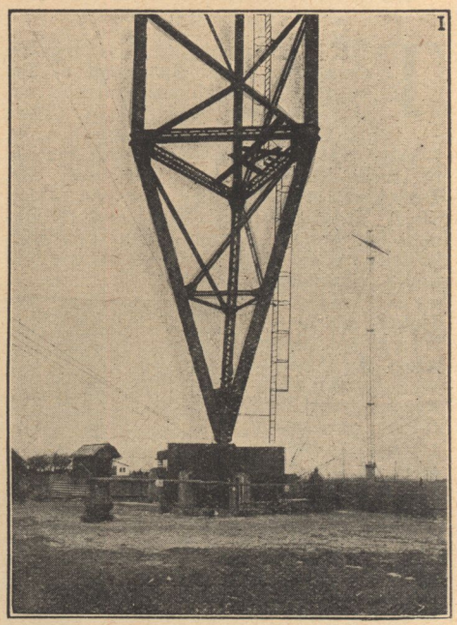
New Facts About The Nauen Station

By DR. ALFRED GRADENWITZ

Berlin Correspondent of RADIO AMATEUR NEWS.



Photograph of the Huge Nauen Radio Station Buildings Showing Three of the Lofty Steel Structures as Well as of the Special Lead-in Tower. Note the Well Planned Layout.



The Pivot Base of One of These Immense Towers. A Sentry Guards Each One of These Bases.

AT the outbreak of the war Germany quickly lost control of her splendid cable system and thus was threatened with complete isolation from the rest of the world, unless radio-telegraphy came to the rescue. Great endeavors were therefore made to improve and develop existing wireless connections, especially with America with which a promising beginning had already been made by the exchange of radio messages between Berlin and New York journalists on February 12th, 1914. The station corresponding with Nauen was the Sayville "Telefunken" Station, Long Island, N. Y., which up to the beginning of 1915 had been operated with a small transmitter of only 35 KW antenna energy, designed on the "musical quenched spark" system. This had originally been calculated only for coast service, transmitting press news to vessels at fair distances, but by no means for Trans-Atlantic service with the Nauen mammoth station 6,400 kms. away. Still, on account of a remarkable improvement in the receiver plant there could be ensured a receiving service for messages sent out from Nauen. On the other hand there was a parallel service between the station at Eilvese owned by the "Hochfrequenzmaschinen," Ltd., and the corresponding station at Tuckerton, which was run with an arc on the Poulsen system and was under the control of the U. S. Navy Department.

At the beginning of 1915 the "Telefunken" Company succeeded in having the Sayville station likewise equipt with a high frequency plant for 100 K.W. antenna energy, which, however, could not begin operation with Nauen before June, 1915. Inasmuch as this arrangement still failed to warrant a satisfactory wireless service all the year round, the decision was arrived at to considerably increase the radiating energy of the Nauen station, thus affording a means of sending news from the Central Powers direct to even far distant neutral countries. It is exclusively to be ascribed to this plan, carried out with the greatest energy, that the News Service blockade imposed upon Germany and her allies was broken at least to some extent.

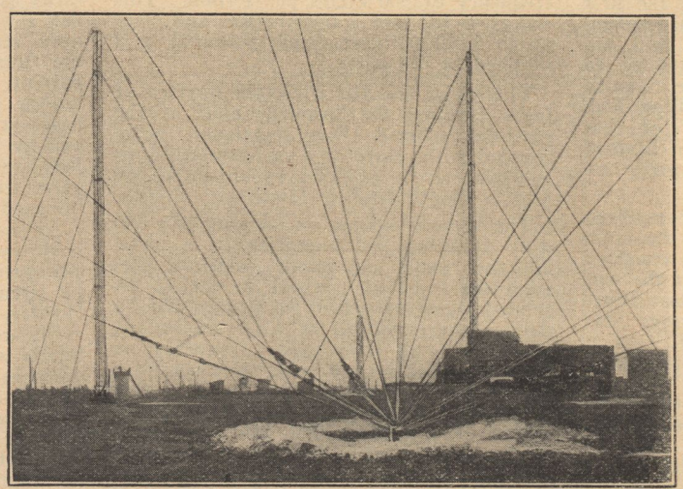
The contemplated increase of the transmitter energy entailed among other things a considerable increase of the antenna capacity, thus necessitating the installation of a most extensive antenna system. A new building was erected to house the new plant, which designed in simple outline, is most impressive from an architectural point of view. The transmitter plant for 400 KW antenna energy was provisionally housed in a hastilly built hall.

There are two antenna systems, the larger one having the shape of T-antenna and serving for high power reception, whereas the smaller antenna, designed in the form of a horizontal triangle, is used for smaller amounts of energy and is placed with its central line at right angles to the huge antenna, energy being supplied at the apex.

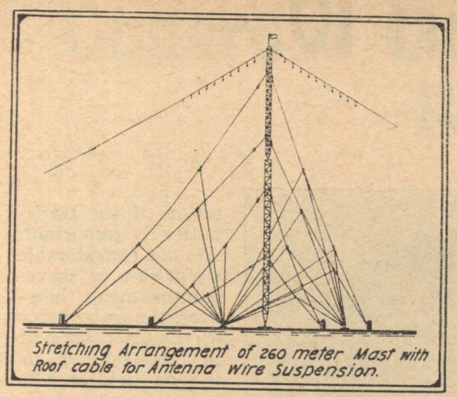
This is the first instance of a double antenna system on a large scale, permitting simultaneous sending, which is made possible both by the relative position and shape of the two antennas, the coupling between them being reduced to a minimum. The possibility of a double service of this kind, of course, makes for greater economy, and at the same time increases the safety of operation, the radio service in the event of a breakdown in one of the antennae being at least partially continued with the other antenna left intact.

All the masts are of the spanned framework construction, resting on a ball joint at the foot, which is insulated from the earth by porcelain blocks. The two masts are each 260 meters in height. In order to reduce electrical losses there have likewise been fitted insulators at the points of stay.

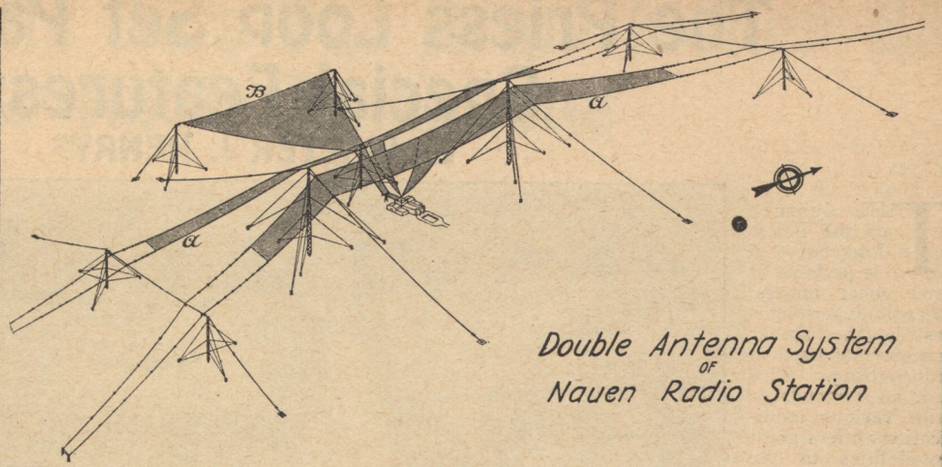
It may be said that nearly all the radio masts erected by the Telefunken Company in various parts of the world are of the same construction and have worked most satisfactorily, especially in countries frequently visited by storms and earthquakes. The greatest difficulties had to be overcome in connection with the design of the big antenna extending over a length of nearly 3 kilometers. The antenna wires in large spans were carried over guiding rollers fixt with special insulators to the roof cables passing over the masts 260 meters in height; this was a particularly difficult part of the task to be solved. Spe-



This is One of the Joining Sections Showing the Wire Stretching Arrangement.



The Sketch on the Left Shows Diagram of Stretching Arrangement; While to the Right the Shaded Portions Show Effective Antenna Capacity.



Double Antenna System of Nauen Radio Station

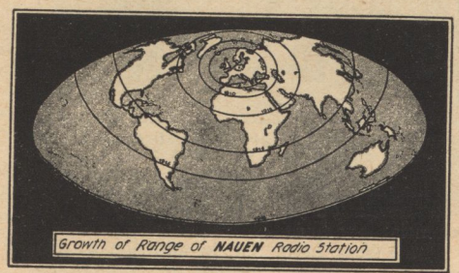
cial compensating devices had to be designed to ensure a compensation of mechanical stresses with heavy gales and particularly in the case of considerable ice loads on the antenna wires. In the spring 1917, for instance, there occurred ice coatings up to 6 cms thick on the antenna wires, attended by wind velocities as high as 25 to 30 meters per second; strain loads never heard of before. The suspension of the huge antenna wires at such enormous height entailed the design of a special break-proof insulator, able at the same time to stand considerable electric tension and being of low weight. Two closed insulator frames were connected with one another, each of which when moist possessed a breaking potential of 100 KW. The antenna frame by means of a special roof cable clamp, is designed on the cardanic principle, fixed to the roof cable carried over each of the two huge towers transversely to the direction of the antenna. The stretching insulators used in this connection are designed to stand a breaking load of 650 tons, this being the only arrangement combining high tensile strength with remarkable electrical strength. The porcelain blocks used to insulate the various insulator frames, stretched independently of each other, has been developed by the Telefunken Company in conjunction with a porcelain factory.

The carriers of the smaller antenna comprise two masts 150 meters high installed at the left and right respectively, the points of which are connected by a wire cable stretched to the right and left and to which the antenna wires are fixed by suitable insulators. The wires are taken towards a guyed mast 134 meters high carrying to the right and left an outrigger 17 meters in length, designed to be walked on. These travel across rollers fixed to these outriggers, to a stretching frame 40 meters high, from which they nearly horizontally pass to the roof of the station building. The frame is designed as an isolated mast and is likewise placed on porcelain insulators.

The huge antenna allows up to 600 KW, the smaller antenna up to 200 KW to be dealt with, any high tensions being safely insulated even in the case of moist weather.

The high frequency machine used to generate the large transmitter energy is designed on the induction coil principle, the rotor with an energy consumption of about 800 HP supply single-phase alternate current of such high frequency as to be stept up to 24,000 periods by two sets of stationary transformers. The antenna gives out the wavelength of 12,500 meters, corresponding to this frequency. The stationary transformers are made of extra-thin iron plate, carrying several sets of windings to take up the direct current used to magnetize the high-frequency alternate current supplied by the machine and to yield the alternate current of doubled frequency. The frequency transformers are placed in iron boxes comprising an oil circulation to carry away any surplus heat.

The new industrial condensers containing no glass and, accordingly, being entirely breakproof, are especially worth mentioning. Their insulating material and armatures, which are designed by a special process, are immersed in oil, serving to carry away any surplus heat. The capacity of these condensers is 60,000, 130,000 and 450,000 cms respectively, their weight with an oil filling being approximately 180 kgs with 75x41x21 cms external dimensions. The copper band of the large-diameter coils in the antenna circuit has been adapted to the considerable intensities of antenna current, the central coil, designed as a variometer, allowing by means of motor driven grips the antenna to be accurately tuned to the vibration circuits.



Circles Show Progressive Growth in Range of Nauen Radio From 1908 to 1918.

A special task had to be solved in designing the key arrangement which by special relays arranged in parallel ensures a telegraphing speed of 200 letters per minute.

The total efficiency, from the energy absorption by the driving motor to the antenna energy, is extremely favorable, being about 65% with a wavelength of 12,500.

The following table resumes the development of the Nauen radio station from 1908-1918:

1908

Masts:	1 of 100m. Height
Antenna Surface:	31,000 sq. meters
Primary Energy:	50 KW.
Antenna Energy:	12 KW.
Mode of Excitation:	Slow Sparks
Range:	3600 kms.

1918

Large Antenna	*Small Antenna*
2 of 260 m. Height	2 of 150 m. Height
4 of 120 m. "	1 of 135 m. "
155,500 sq. ms.	77.50 sq. ms.
600 KW.	175 KW.
400 KW.	100 KW.
High Frequency Machine	Musical Sparks
20,000 kms.	8,000 kms.

Inasmuch as the consequences of the war left Germany without any trans-ocean cables of her own, the wireless service, being the only means of communicating with the outside world without the control of her late adversaries, will be of even more vital importance to her than to any other country. It may also be said that the enormous strides made in the development of wireless telegraphy and partly embodied by the growth of this mammoth station would hardly have been possible but for the enormous stress of the critical period the country had and still has to go through.

What Senate Leaders Say Concerning Radio Legislation

By Our Washington Correspondent

THE following shows briefly what some of the senators at Washington think concerning government ownership and operation of radio. Everyone knows by this time that all radio stations taken over by the government during the war were formally returned to their owners on February 29, 1920, and to all appearances the provisions of the act to regulate radio communications approved August 13, 1912, are again is force.

This means that the government can no longer use any of its radio stations for general public service when another commercial radio station is in a position to operate continuously wtihin a radius of 100 miles of the government station. Some of the senators believe that an arrangement of this kind is detrimental to American business interest and particularly so to the press, for it is claimed that at present there is no radio company equipt to handle large amounts of traffic.

For that reason the senate would authorize the secretary of the Navy to permit the use of radio stations under the control of the Navy Department to exchange commercial messages between ship and shore station for the benefit of the general public.

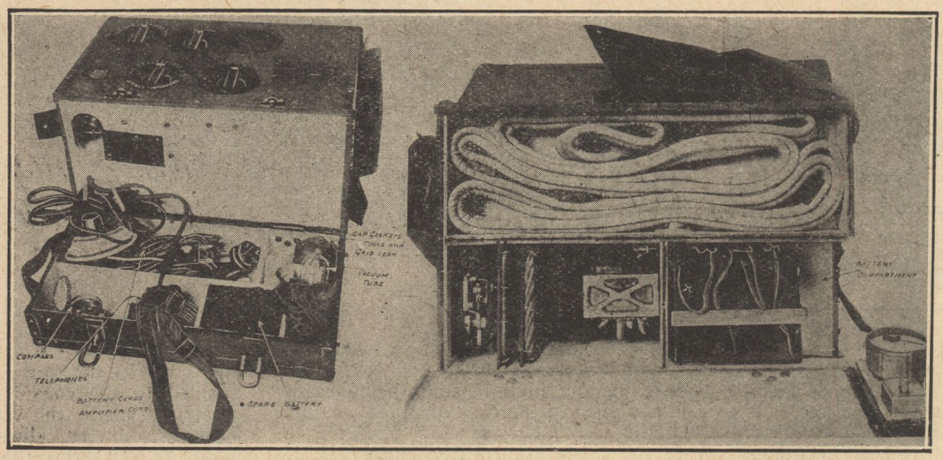
The position taken by Senator Poindexter is, that the Navy Department, while controlling radio, has been furnishing a low press rate to the Orient as well as performed commercial work in districts where private facilities were not available, and altho he does not believe in government invasion of fields of private interest, nevertheless the government is now in a position to furnish adequate service, altho present radio communication is a

(*Continued on page* 585)

The Priess Loop Set Part IV.— Special Features.

By WALTER J. HENRY*

THE feature of the Priess Loop Set that is perhaps of most interest to radio experimenters is the buzzer transformer used in transmitting. This unit as it stands or with various modifications offers great possibilities to the experimenter whose source of power is limited to batteries or a direct current line. This buzzer is a modified and improved form of the German buzzer captured by the French Signal Corps. The wiring hook-up is shown in the complete transmitting wiring diagram shown in Part II. in the January issue of the RADIO AMATEUR NEWS.



To the Left of the Above Photograph Shows the One Section of the Loop Containing All Spare Parts and Accessories, While to the Right Shows the Section of the Loop Containing the Main Parts of the Set. As May be Noted the Frame Work Collapses and Loop Folds Into a Special Compartment.

This buzzer operates by means of a 10 volt storage battery which draws from 50 to 100 watts on locked key, depending upon the thickness of the gaskets used in the spark gap, and the state of charge or discharge of the storage battery. It transforms the ten volts D. C., to 3000 volts 500 cycles, with an overall efficiency of approximately 65%. The buzzer operates on the principle of radio frequency quenching at the break. The three microfarad condenser in the base of the buzzer, is connected across the outer contracts of the break and is charged to double the D. C. voltage when the D. C. current has built up to its maximum value, previous to breaking at the contacts. When the D. C. current reaches the value causing a break at the contacts an arc is drawn following the movable contact until it strikes the opposite fixed contact. At this point, the condenser discharges with its current opposite to the arc current. When the two currents become equal, the arc is extinguished. The time required for the two currents, i. e., arc current and condenser current, to become equal depends upon the natural period, the capacity and the resistance of the condenser circuit. The radio frequency quenching circuit includes the condenser and the leads to this condenser. The gap length in operation is but a few mils.

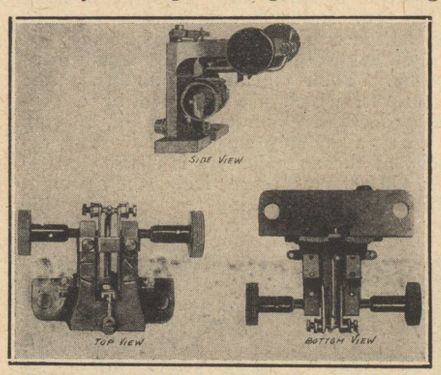
The buzzer contacts may require touching up after six months' service. A fine file and a fine emery cloth are provided to square them off, and spare outside contacts are provided for replacement. The contacts are of platinum iridium alloy and should not be filed unnecessarily.

When adjusting buzzer, the antenna switch is kept in off-position and side contacts are adjusted so that the armature floats freely between them with a gap on each side wide enough to slip in one thickness of paper.

Two small key wrenches are provided in the spare part compartment for the contacts and lock nuts. After the contacts are properly set, the knurled screws are locked by tightening the vertical hex bolts just in front of them.

The loop used in this set is of special interest. It takes the form of a square, one meter on each side. The frame work collapses and the loop folds into a special compartment.

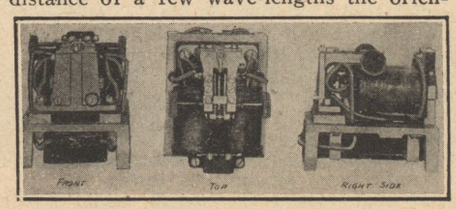
The loop is built of three turns of conductor. The conductor for each turn is made up of 3/16" diameter copper braid (8x24xNo. 38) over a jute center, with cotton braid and rubber covering. Three of these conductors are then sewed into balloon cloth with a separation of 1⅛" between the centers. This provides a well insulated loop capable of operation in rainy weather. Insulation on transmission is not necessary as the potential gradient is along the length of the loop. However, on reception insulation is very necessary as the potential gradient is transverse.



This Photograph Represents Three Different Views of the Buzzer Contacts and Vibrator.

The Priess Loop Set, in addition to providing a compact means of communication, may also be used as a direction finder in locating enemy signal stations.

A compass is provided in the lower compartment for the rough orientation of the loop. A loop transmitter and receiver system transmits a maximum when the planes of both loops are parallel and lay in the line connecting the two sets. Within the distance of a few wave-lengths the orientation of the transmitter is important. At a considerable number of wave-lengths away, however, the importance of the orientation of the transmitter is not as great. The radiation acts similar to a search-light beam of light in a fog. Near the source, the directive effect is great. At great distances from the source, the directive effect becomes less marked. In all cases, orientation of the receiver follows a definite law. Neither the minimum nor the maximum are sharp for the received system provided in this set as the loop used is unbalanced. That is to say, the capacity to ground on one side of the loop, figured from the terminals of the tuning condenser, is greater than the capacity to ground on the other side of the loop, figuring from the other terminal of the tuning condenser. The compass is equipt with radiolite north and south points, so that orientation may be made in the dark.



Reading From Left to Right the Above Three Cuts Represent the Front, Top and Right Side View of the Buzzer Used With the Priess Set.

The radiation of the Priess Loop Set is very sharply tuned, the decrement being less than .02.

Below is a table of actual results obtained in transmitting on an official test:

Wave Length Meters	Volts	Input Amps.	Watts	Radia'n Amps.
Long Wave... 137.3	9.2	9.5	87.3	9.6
Medium Wave 123.0	9.4	9.0	84.6	8.4
Short Wave... 108.0	9.5	9.25	87.9	7.7

(The fifth and last article in this series describing the operation of the Priess Loop Set under actual warfare conditions will appear in the May issue of the Amateur Radio News.)

APPLICATION OF THE RADIO COMPASS TO NAVIGATION.

Two Methods: The application of the radio compass to navigation can be accomplisht by two distinct methods; the radio compass apparatus can be installed ashore or on board ship. We shall review the advantages and disadvantages of these two systems:

FIRST: RADIO COMPASS SHORE— ADVANTAGES.

This method has the advantage of requiring a limited number of installations; for example, twenty radio compasses spaced along the coast of France and Algeria supply approaching ships useful information concerning their position. The personnel for the operation of these stations can be *highly specialized and permanent.*

The installation of the apparatus can be more easily accomplisht than aboard ship. No consideration intervenes to limit their dimensions and weight.

DISADVANTAGES.

It is difficult to locate radio compass stations in certain localities so that they will give exact bearings; this is the case where the coast line is very irregular or too stiff; a certain length of time often intervenes between the time when the ship needs the bearing and receives it. This is the case

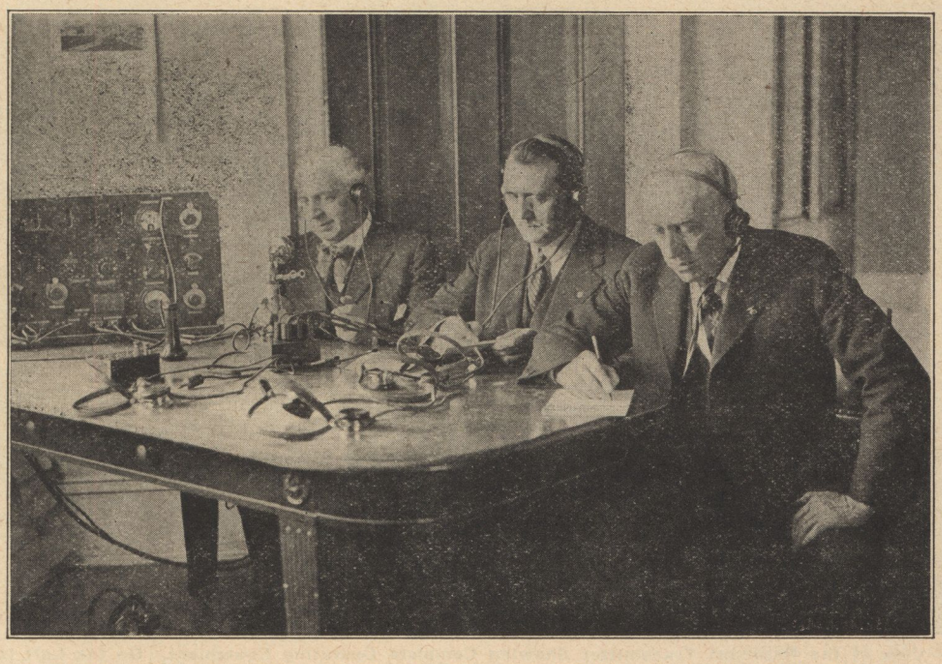
(*Continued on page* 576)

* *Sales Manager, Wireless Specialty Apparatus Co.*

Congress Gets Data For Army Money Bill By Radio Telephone

FOR the first time since its perfection by Marconi, radio is being personally used by Congress to gather official data in making up a money bill. The House military affairs sub-committee now considering the Army appropriation bill for the fiscal year beginning July 1, 1920, is using the radiophone in communicating with Army officers while the latter sit in their offices in and near Washington.

When $6,686,000 was asked for the Signal Corps Service, members of the committee raised a cry against an increase from the appropriation of $3,250,000 made last year. Expert Signal Corps Service officers forthwith brought in complete sets of radio instruments and installed them in the Capitol.



Three Members of the Military Affairs Sub-Committee Making Use of the Radio Telephone. The Earnestness of These Senators as They are Making Notes Closely Resembles That of Some of Our Up-to-the-Minute Amateurs. Cheer Up Boys, Perhaps We May Now Look Forward to Some "Live" Legislation Benefitting We Amateurs.

The receivers were fixt over the ears of the members of the committee and the hearings began. With certain extra equipment congressmen can communicate with airplanes as they fly over the Capitol. From left to right are: Representative Julius Kahn, California; Representative Wm. J. Fields, Kentucky; Representative John C. McKenzie, Illinois.

Representative Kahn is doing the speaking, using a regular desk type telephone set, while Representatives Fields and McKenzie are "listening-in." Note the plugging-in block in the center of the table as well as spare head sets. The Radiophone employed and which can plainly be seen at the left of the picture is a regular Signal Corps set.

Timing Torpedoes By Radio

By STANLEY E. HYDE

THE time that elapses between a torpedo leaving the tubes of a submarine or other ship of the navy and striking or passing the target is not of material interest to civilians in general, but it is of great interest to those officers in charge of the Ordnance Department on a modern war vessel.

A miscalculation of only a few seconds might mean that the speeding torpedo, traveling at the rate of 45 to 50 knots, will pass to the right or left of the enemy, perhaps only by a margin of one foot, but a "miss is as good as a mile," and means failure to injure the enemy and the loss of the torpedo.

In peace time the "war head" of a torpedo is replaced by a dummy head, which renders the torpedo non-explosive and helps to keep it afloat after the comprest air that propels the torpedo is exhausted. Fig. 1 shows a "spent" torpedo being made ready for towing back to the ship from whose side it was discharged. In the head of the torpedo on the top side is a small cup filled with a chemical that ignites as the torpedo comes into contact with the salt water. This slow combustion generates a white smoke, and it is by this method that the torpedo is sighted, as otherwise much time would be lost in hunting the torpedo, which lies half submerged on the surface.

Fig. 1. The "Spent" Torpedo Being Made Ready by Sailors for Towing Back to the Ship Which Discharged It.

Fig. 2 shows the target, a small red flag held up by a barrel buoy, and which may be from 4,000 to 6,000 yards away from the maneuvering ship, which may steam along at varying rates of speed.

Fig. 3 illustrates the small portable radio set that is sometimes used with torpedo practice. The radio hand generator is shown in Fig. 4, its handles being turned by two husky sailors. It generates 5 or 6 amperes at 150 volts pressure, with a frequency of 500 cycles (if the sailors turn the handles fast enough).

A small fly-wheel will be noticed on the end of the generator. These small sets are mounted in a motor sailing launch with an improvised antenna about 15 ft. high and the length of the boat. A ground connection is obtained by connecting a wire to some pieces of metal and lowering it over the side of the boat.

The primary and secondary of the oscillation transformer will be noticed in Fig. 3, also a transmitting loading-coil on the near end of the suitcase container. A small quenched gap discharges the mica condenser.

An aerial switch changes the antenna from the transmitter to receiver, which consists of a tuning transformer, crystal

(*Continued on page* 578)

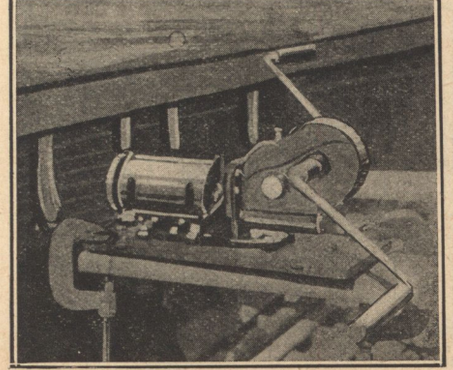


Fig. 2. Hand Generator Operated and Controlled by Two Husky-Sailor-Power.

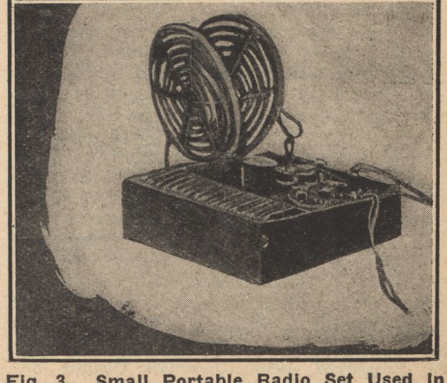
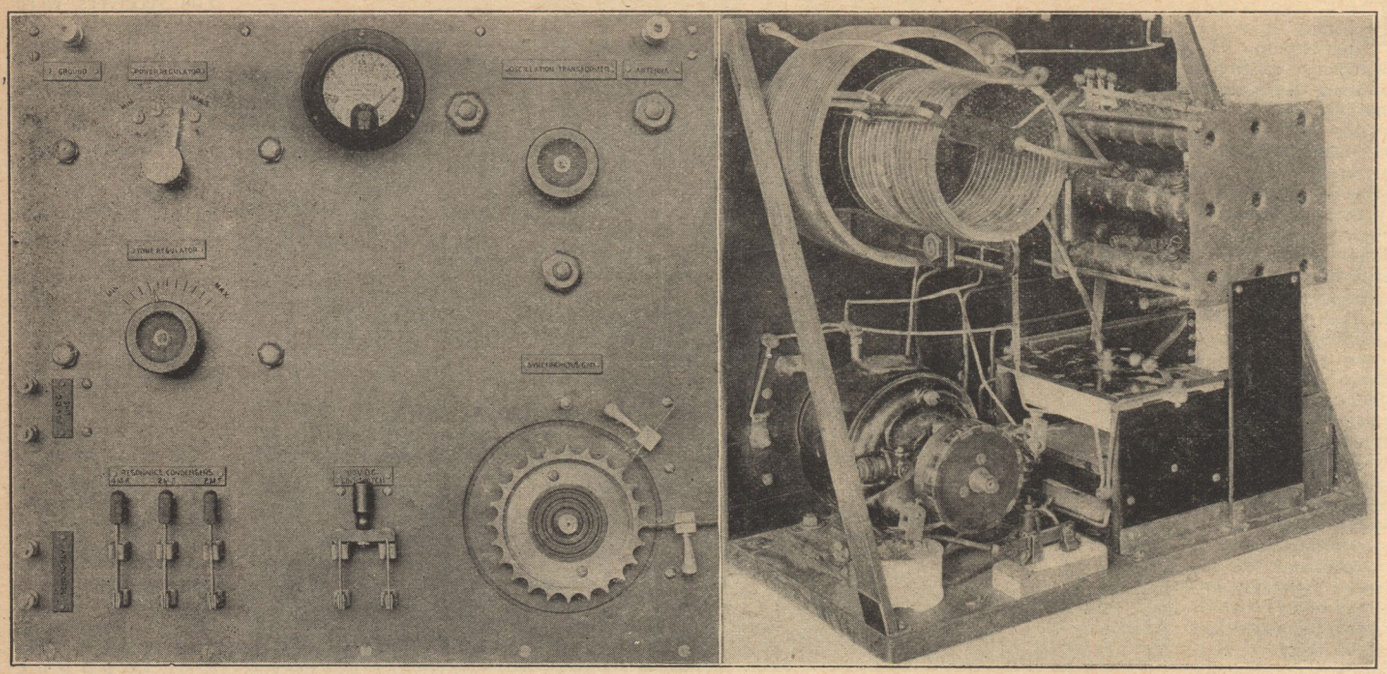


Fig. 3. Small Portable Radio Set Used In Torpedo Practice.

The Resonant Converter Transmitter

A New Form of Spark Transmitter Exceptionally Suited for Amateur Work



To the Right Is a Rear View of the Resonant Transmitter Showing Complete Operating Equipment. On the Left Is Shown the Front or Panel With Controlling Appliances. Note Effective and Well-Planned Layout.

(Ed. Note: Mr. Lemmon has kindly given RADIO AMATEUR NEWS *the first option to describe this new invention. This is the first published matter concerning this subject to appear in any publication.)*

THE Resonant Converter is the invention of Mr. Walter S. Lemmon, an electrical engineer, well known in radio circles and who spent four years of research work in order to develop the invention; part of this research work being done at Columbia University.

Altho a patent for this device was applied for in the summer of 1916, the inventor was called into the naval service, and this of course interrupted the commercial development of the machine until the conclusion of the War. A patent for this device had been allowed, however, and will shortly be issued.

WHAT IT IS.

The most important points of this new invention may be briefly described under three general heads as follows:

(1) The Resonant Converter essentially is a simple and *inexpensive* device for converting ordinary commercial direct current to alternating current having a pure sine wave form at any desired frequency.

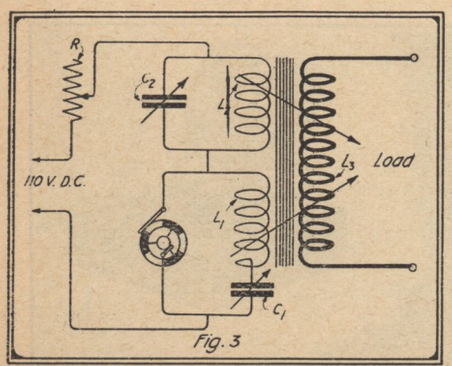


Fig. 3

The Two Circuits, L1, C1, and L2 and C2, Are Employed With Common Output or Load, L3.

(2) Altho the device is of the mechanical type many important features distinguish it from the various commutator arrangements which have been brought out from time to time, any of which had the severe disadvantage of considerable sparking when in operation. In this device even when employing large power, no harmful sparking is produced at the point of make-and-break. This admirable advantage is directly due to the correct principle upon which the machine is designed..

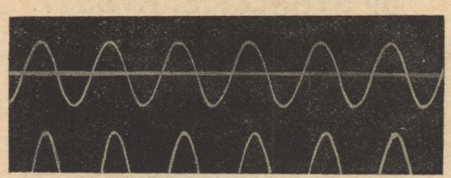


Fig. 1. An Interesting Oscillogram of the Resulting Wave Shape Which Is Remarkably Sinusoidal.

(3) The wave of the alternating produced is remarkably sinusoidal in shape. This may better be illustrated by studying the oscillogram of the output current, Figure 1. This wave shape is admittedly better than that produced by most commercial alternators.

PRINCIPLE OF OPERATION.

Briefly, a simple form of this apparatus consists of a rotary make-and-break and an oscillating circuit tuned to the *number of makes and breaks per second.*

The fundamental principle of operation is to impose a series of charging pulses on a resonant circuit, see Fig. 2, which are exactly timed and of proper duration so as to set the resonant circuit L1, and C1 vibrating at *its own natural frequency.*

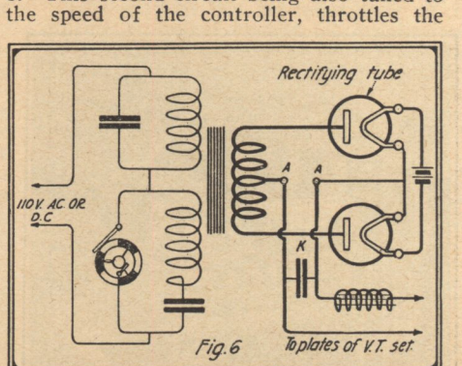
A mechanical rotary break or circuit controller is used to properly time these pulses, and the same device allows the energy stored in this circuit to oscillate freely.

Since the resonant circuit discharges at the same frequency at which it charges, but in the opposite direction, this means, therefore, just at the point of break the resulting current thru the controlling mechanism is practically zero and no sparking results.

Therefore the rotary mechanical controller operates synchronously with the resonant circuit and consistent with proper design, the time of charge and discharge is equal. This tuning of the circuit has been found the most efficient method of properly operating device of this kind. In this case, to change the frequency it is merely necessary to change the speed of the controller and correspondingly vary the tuning of the resonant circuit, i. e., vary L or C accordingly.

FEED CONTROL.

In order to prevent a rush of current through the controller when it instantaneously short circuits the D. C. supply, a resistance may be inserted in series for low powers, as shown in Fig. 2. It should be noted that this resistance does not affect the timing of the controller and its circuit. For higher powers where a resistance would be wasteful, a second tuned circuit consisting of inductance and capacity in parallel may be inserted in the supply leads, Fig. 3. This second circuit being also tuned to the speed of the controller, throttles the



In This Case the Resonant Converter Is Employed to Supply the Necessary High Plate Voltages.

current supply without modifying the essential circuit constants.

. It was found that the circulating alternating current in this resonant control circuit was in phase with the output of the machine. Hence by coupling these two circuits L1 and L2 to a common output (secondary) L3 *the system becomes regenerative and the output amplified.* An amplification of approximately 30% is thus obtained.

In actual apparatus both these inductances may form the primaries of a transformer with a common secondary coil. The *inductances are large* and the primary *condensers small,* so that their characteristic losses may be cut down. For low powers, paper condensers may be used, but for higher powers over ¼ K. W. mica condensers are preferable. The rotary controller of one model consists of a disc containing insulating and conducting segments of equal length and driven by a small motor.

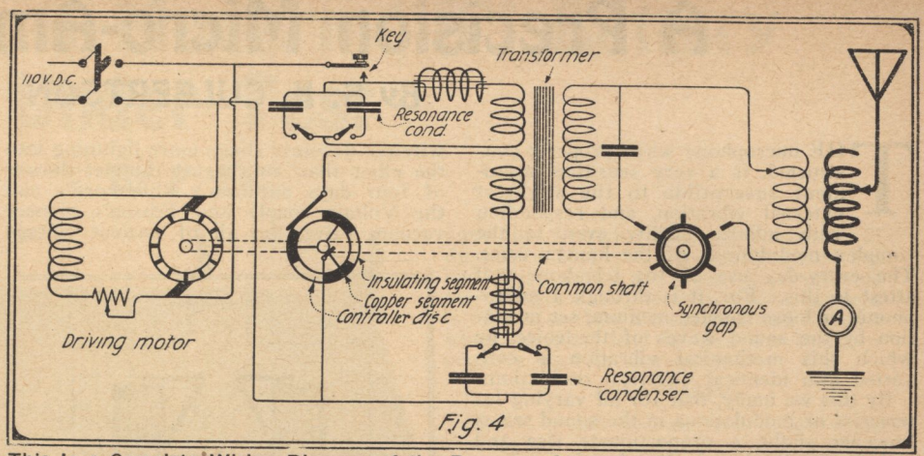


Fig. 4

This Is a Complete Wiring Diagram of the Resonant Converter Transmitter as Applied to Radio Telegraph Operation. The Dotted Line Represents a Common Shaft Between the Driving Motor, the Controller Disc and the Synchronous Gap.

PRACTICAL CONDITIONS.

In actual apparatus the tuning of these various circuits is not as sharp as may be at first supposed, since the machine functions over quite a speed range. The adjustment is very simple, resonance being obtained when sparking ceases or when ammeter A which is introduced in the resonant circuit shows maximum current. Also a good and pure wave as well as sparkless operation is produced under various operating conditions so that the apparatus is quite rugged.

With experimental apparatus frequencies have been produced from 10 cycles to over 2,000 cycles—mechanical limitations of course seems to prohibit frequencies over 20,000 cycles from being obtained. Powers up to 1 K.W. have been easily handled, and with improved design this may be exceeded. The machine will operate on supply potentials ranging from 30 to 200 volts. With future commercial refinements some interesting results will probably be developed. At present the efficiency of conversion even in experimental apparatus, has been found to be from 60 to 70%.

APPLICATIONS.

The resonant converter has several unique uses, among which may be described the following:

(1) Production of A C for the laboratory, such as bridge measurements and other forms of testing.

(2) As a radio spark transmitter where it does away with the motor generator of spark type radio sets, thereby eliminating a very common source of trouble.

(3) As a modulator for V. T. sets.

(4) As a supply of high voltages for the plates of vacuum tube transmitters.

These applications may be outlined in a more explanatory manner.

(1) Besides the radio applications of a part of the device, there are other uses, such as the production of any frequency currents of small powers for laboratory use and X-ray machines.

(2) At the present time there is a great need for simple radio sets for shipboard use such as cargo ships, small vessels, yachts and motor boats. Apparatus of this type is also very well suited for Amateur adaptations.

As vacuum tube sets are developed for shipboard use, a simple reliable auxiliary spark set will also be needed. For these purposes a radio transmitter based on the principles of the Lemmon Resonant Converter is a complete solution. An important feature, from the amateur viewpoint, is that a set of this type, when properly constructed, will operate from ordinary A. C. voltage.

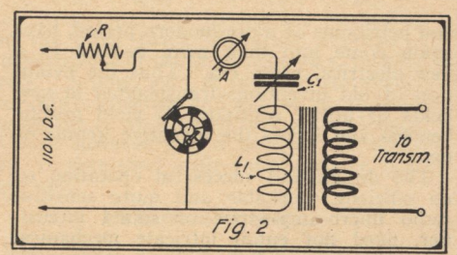


Fig. 2

Elementary Circuit Illustrating the Resonant Principle Where L1 and C1 Vibrate at Their Natural Frequency.

The first application of the principles above stated was in connection with the amateur radio station of Mr. Lemmon in 1912. No doubt many amateurs around New York will recall the clear musical spark tones of 2IE, JG and 2IC where the early experiments with this type of apparatus were made, and with which distances ranging up to 800 miles were easily covered.

With the resonant converter a synchronous spark gap is admirably well adapted since it can be mounted on the same shaft with the controller and the position of the spark is accurately timed with regard to the primary wave. The advantages of this added feature were clearly recognized by Mr. Lemmon and in fact the first radio set was constructed on this basis early in 1912, altho the quenched gap was also employed with good results. For small power sets, however, up to 100 watts it is possible to obtain clear musical tones from even a straight gap properly constructed.

This set has the distinct advantage for amateur use in that the spark tone may be quickly varied to any musical tone from 120 cycles to 500 cycles so that the set carries remarkably well through interference.

DESCRIPTION OF EXPERIMENTAL SET.

A photograph of a complete transmitter for experimental purposes capable of adjustment from 100 to 400 watts is shown herewith. The design is extremely simple and is of the panel type.

A line switch starts the small driving motor, and the sending key is connected to the proper posts.

A rheostat marked "tone regulator" varies the motor speed over a wide range so that tones from 240 to 500 cycles can be produced at will. The resonant tuning condensers are adjusted by means of a set of switches. It is not necessary to accurately set these condensers since the set operates very well with an approximate setting.

The power input of the set can be regulated by the upper control switch.

The radio circuits consist of a specially wound radio transformer, a mica condenser and an oscillation transformer. The rotary synchronous spark gap projects through the panel and contains twice the number of teeth as there are segments on the controller. This gives two sparks per cycle as in ordinary shipboard radio sets. The rotary controller disc mounted on the other end of the shaft consists of a series of conducting and insulating segments of equal length contact is made by metallic brushes, so that equal time of make and break results.

Since these sets eliminate the expensive motor generator which is often troublesome, they form excellent auxiliary sets for shipboard to be used in connection with ships storage cells.

With the great interference which is constantly increasing, the fact that they have a widely adjustable musical spark tone will also find great favor with operators. In fact, these transmitters will work hand in hand in the new *Armstrong Super Amplifier* which retains the musical spark tone in the receiver and allows long ranges to be covered with small size transmitters.

The resonant converter transmitter can also be made to operate from AC supply with a clear tone providing of course that transformer and other appliances are properly designed and their constants balanced for this use. Taken in all, this device will probably become a popular amateur transmitter in the very near future.

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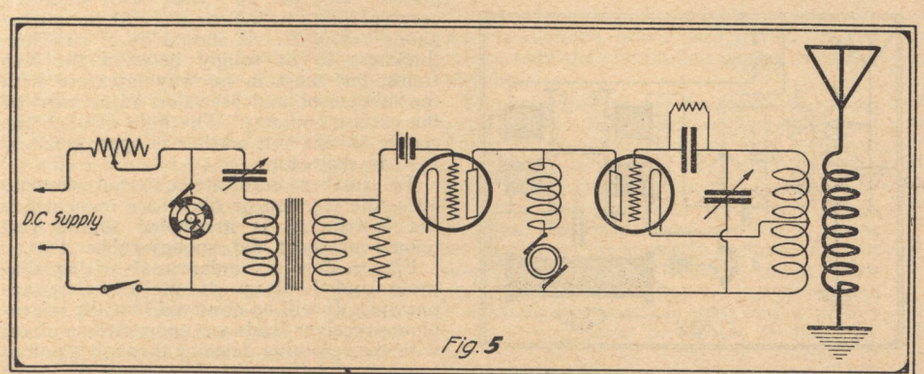


Fig. 5

In This Instance the Resonant Converter Is Employed as a Buzzer Modulator. Ideal for Telegraphing on Short Waves.

A Precision Micro-Ampli-Fone

By S. K. CULBERTSON

THE microphone when properly constructed, is a very sensitive instrument susceptible to the slightest external vibration, and responding with infinite fidelity even to the complex modulations of the human voice. The every-day use of the telephone will attest to this. For, it is through a microphonic or loose coupled medium, set in motion by the sound waves of the voice, by which this mechanical vibration is converted into identical electrical oscillations.

By this we imply, that for all varying intensities or modulations in the sound wave, however slight, a proportionate rise and fall in amplitude of the electrical vibration will manifest itself. These electrical surges of varying intensity traverse the external circuit and create a similar fluctuating magnetic field in the receiver; and in turn, actuate the metallic diaphragm, which vibrates with frequencies and amplitudes corresponding to those of the transmitter,—thus reproducing the original sound wave with all its acoustic identity. But, of course, due to mechanical absorption imperfections, etc., as well as electrical inertia and losses, the accentuation is but a mere pulsation in the ordinary telephone; inaudible unless the receiver is placed to the ear.

The micro-ampli-fone is a device to assist in overcoming this difficulty. As the name implies—"little sound" intensifier—it is especially adapted to augment the reception of faint and distant wireless signals. Several commendable types have been developed to a high degree of theoretical perfection. Some are quite simple, while others are more elaborate incorporating a "regenerative" or feed-back system. Whatever their mechanical features, good, bad or indifferent, they all embody the fundamental principle of the microphone: a loose contact, devised to fluctuate the strength of an electric current thru the *vibratory electro-reaction* of a variable resistance.

Some very "fetching phraseology" has been applied to these microphonic relays, amplifying relays, sound intensifiers, etc. But due, more or less, to the great difficulty experienced in maintaining a permanent adjustment, they have not met with much favor commercially. Even the up-to-date experimenter has failed to appreciate the flexible latitude and experimental possibilities of this little device.

Unlike the over-worked electrolytic detector, which first evolved into a highly scientific novelty, and then quickly volplaned to the level of the lowly potato detector with two needle electrodes, the radio value of the microphone as a receiving adjunct, has advanced but little in the experimenter's laboratory. The graphite pencil stick resting lightly upon the up-turned edges of two safety razor blades; or, two beveled sticks of carbon supporting several needles, under which is placed a dilapidated deaf and dumb-watchcase wireless receiver with ear-piece and diaphragm removed—or some such inoperative contraption—and the microphone has reached the experimenter's limit of perfection. Perhaps it is one of those antiquated discoveries applicable to other electrical fields, but has not yet found itself identified in wireless telegraphy.

The Leyden jar is a fair example of electrical antiquity, too; yet this obsolete instrument is manifestly a shocking success in the electro-static field of present day wireless. The antenna is but an elaborate lightning rod. And how our dwellings used to fairly bristle with these safety conductors of the Almight's hurtling thunderbolt. Today, in a single evening, the average wireless devotees slings more lightning into the ether than an August thunder-shower of four days duration. Rhumkorff's coil the Voltaic couple and Edison's pioneer vacuum valve, tho all of ancient vintage

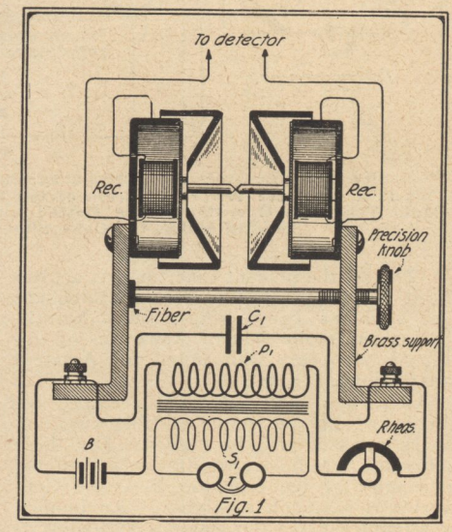


Fig. 1

This Is the Operating Circuit of the Micro-Ampli-fone, Which Is Somewhat the Same as a Telephone Transmitter.

and heirlooms of a pre-modern period, have again come into their own, re-born in a new electrical radio era. Thus the evolution of old inventions transplanted in new fields of utility continues to yield prolific benefits and serves the inventive genius of man.

The design and successful operation of an efficient, workable and quite sensitive radio micro-ampli-fone or sound intensifier, need not entail intricate mechanical difficulties beyond the reach of any experimenter. Figure 1 depicts the idea in a nut shell. Divested of non-essential details, the constructional features, at a mere glance, become greatly simplified.

Two metal cased wireless receivers are mounted rigidly upon heavy brass strips, as shown. A small piece of flashlight battery carbon, ½" in length, with diameters filed down considerably—terminating in a rounded point—is soldered to the diaphragm of each fone. Since the carbon rods are metal capt this may be readily accomplisht.

An adjusting thumb screw is threaded thru one brass support and is of sufficient length to engage the thin strip of insulating fiber affixt to the opposite standard.

It will be observed, Fig. 1, that in mounting, the receivers are so placed, that the carbon sticks contact concentrically with a firm pressure. This tension is easily regulated by a turn of the precision knob, until the desired pressure and *critical point of sensitivity is obtained.* It is only through repeated experiments that the peak of such an adjustment is found.

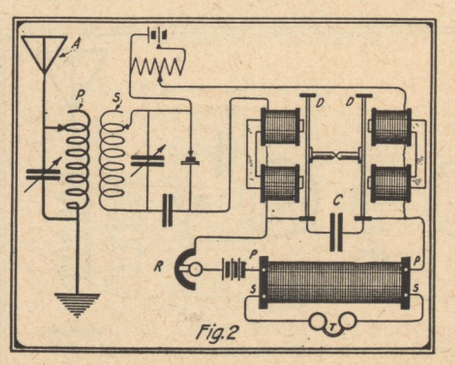


Fig. 2

In This Diagram We Have a Fundamental Wiring Hook-Up of the Complete Apparatus.

The microphonic hook-up is somewhat similar to that of an ordinary telephone transmitter. The primary of a telephone induction coil is inserted in series with the batteries B,—Fig. 1—and the carbon rods, to which circuit is also added a small regulating rheostat. A small stopping condenser is connected directly across the terminal binding posts. Tracing the circuit, it will be found that this condenser not only shunts the primary of the induction coil but the carbon contacts, as well.

The object of the induction coil is to mitigate that detrimental and by no means desirable scratchy "fry" evinced by the carbon-carbon loose couple. Then, too, the slightest flutter of the micro-ampli-fone diaphragms with the resultant current displacement, creates a fluctuating magnetic field of considerable density around the induction coil. The secondary transposes this low voltage energy at a much higher potential directly into the receiving telephones, which are connected directly across its terminals. This arrangement permits a low voltage primary, while the secondary impress is of sufficient strength to compensate for telephonic or line resistance, should the experimenter care to erect a party line.

Acting as a shock absorber of counter E. M. F. or deterrent self-induced electrical surges, due to a fluctuating primary current while the instrument is in operation, the stopping condenser is a further augmentive addition, though not an essential one. Absorbing and dissipating this electro-dynamic inertia, then abruptly discharging it's potential energy through the primary, thereby increasing the "sharpness of the magnetic movement, the ultimate results of which are clear and well defined signals in the receiving telephones, the condenser as a capacitive element is well worth consideration.

The rheostat, of course, regulates the battery current within definite critical limits, which is highly desirable. For, correct values of current, in conjunction with the looseness of the carbon coupling adjusted with the utmost precision, are the potent factors that determine the sensitivity, amplification characteristic and general utility of the apparatus.

Complete elimination of external vibrations, which are a constant source of annoyance—particularly in radio work—is hardly possible, but they may be appreciably diminished. From a piece of soft pliable saddler's felt fashion a "muffler gasket" at least ½" wide with diameter corresponding to the ear-piece of the microphone receivers. It should be of sufficient thickness to fit snugly between the two fones, but must in no way interfere with the movement and precision adjustment of the carbon contacts. The hole through the center of this felt washer is approximately 1½" in diameter.

To further eradicate external disturbance, the wooden or fiber base upon which the instrument is assembled should rest upon four short, flat, spongy-rubber legs.

Figure 2 is a fundamental wiring diagram and hook-up of the complete apparatus. It will be observed that the microphone-receiver leads are connected in shunt with the receiving detector through a potentiometer. Adjust the detector with a test

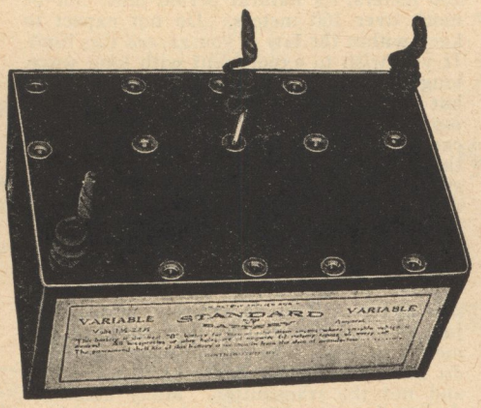
(*Continued on page* 579)

Behavior Of A Modern "B" Battery Under Test

By P. EX.

THE subject of the "B" battery, while a much talked of one, seldom is given very much technical attention. It is usually purchased in units, placed in a V.T. circuit and when exhausted is ungratefully thrown out and very little effort is made to ascertain if it could have lasted a while longer. Of late, however, a great number of "B" batteries have been placed upon the market, and judging from the claims of various manufacturers a little more "digging" into the whys and wherefors seems to be apparent.

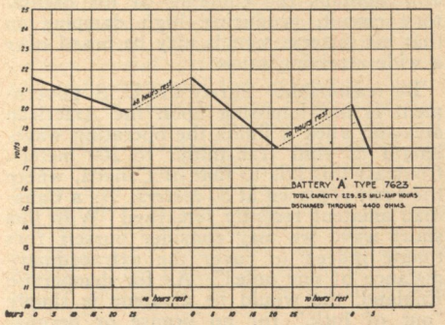
An ideal "B" battery has lately been placed on the market by a New York concern which has taken the trouble of investigating its behavior under severe operating conditions. This battery, a photograph of which is herewith reproduced, is unique in its makeup in the fact that it is supplied with variable taps. This tapping is accomplisht by means of plug and flexible leads attacht as will be noted from the illustration. The voltage is thus made variable from 1½ to 22½ volts with an operating amperage of from 7 to 9 amperes. This gives the battery approximately 1,200 operating hours. The size of each unit is 6½ inches by 4 inches and 3 inches high; a very appropriate size for average receiving panel construction.



Note the Tubular Rivets, Any of Which May Be Plugged in for Voltage Variation.

GENERAL DESCRIPTION.

Each unit is composed of fifteen cells connected in series, contained in a paraffin impregnated cardboard container ⅛-inch thick. Each cell, with the exception of the first and last ones, has fastened thereto a brass eyelet which is first compresst at the lower end and then soldered to the zinc of the cell. This makes an airtight connection. A sealing compound seals the entire unit and the eyelets extend flush with the top of the sealing compound. Wire leads extend from either corner of the battery unit, one having red insulation and the other black insulation, representing positive and negative polarities, respectively. A plug, split at one end for resiliency when inserting and exaracting it from the eyelets or receptacles, and with a length of wire soldered into a hole on the other end, is furnished with each variable battery unit.



Graphic Action of One Type of B Battery Under Test.

METHOD OF USING.

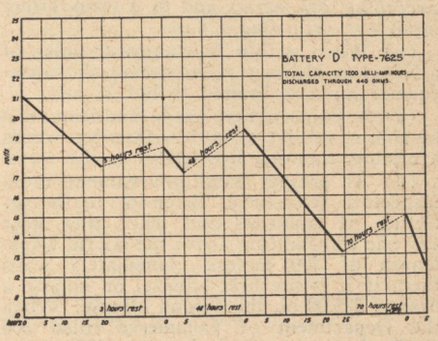
The lowest voltage which can be derived from this unit is 1½ volts. This may be obtained by inserting the plug in the first receptacle, or that nearest the red lead. Since all receptacles are of negative polarity, being connected directly to the zinc of each cell, the first cell will only be in use, the plug lead furnishing the negative pole and the red lead the positive pole. If three volts are desired, the plug is taken out of the first receptacle and is placed in the second receptacle, and so on until the desired voltage is obtained. If the entire 22½ volts are desired, the red and black leads are used, thus utilizing the voltage of all the cells. The plug lead is of course then disregarded and likewise when the plug lead is used the black or negative lead is disregarded.

ADVANTAGES.

Should a cell become bad or go dead, the use of two plugs connected together with a wire will make a bridge over the dead cell and thus prolong the life of the remaining good cells. With this variable battery unit the use of the graphite potentiometer in shunt across the battery unit is needless, and the batteries will therefore last much longer since they do not pass thru a resistance, but are directly connected in the plate circuit.

GRAPHIC PERFORMANCE.

Fig. 1 and Fig. 2, respectively, shows behavior of two types of this battery under rather strenuous operating conditions; that is, Fig. 1 shows the test of a 1200 milliampere unit discharged thru 440 ohms and the other test shows another type unit with a total capacity of 229.55 milliampere hours discharged thru 4400 ohms, in which the battery was on duty for 25 hours, then given a 48-hour rest, then on duty for another 25 hours, then was given a 75-hour rest and finally furnisht an additional 5 hours' test.



Latest Types of This B Battery Show Even Better Performance Than These Two Graphs Illustrate.

Underground Radio In Holland

By Our Dutch Correspondent N. VAN. DOLDER

IT would seem that here in Holland underground radio has had considerably more success than has been mentioned in contemporary periodicals, except for the very interesting articles on this subject which appeared from time to time in RADIO AMATEUR NEWS and *Electrical Experimenter*.

For this reason perhaps a little information concerning what Holland has done in this direction is not untimely. Mr. Vlug (the Amercan equivalent would be Mr. Quick), a well-known radio inventor, has succeeded, after two years' experiments, in receiving, very effectively, radio stations as far as the Dutch East Indies, while the signals of American stations came in exceedingly loud. He is at present securing a patent on his invention and according to local forecast this may result in a complete change of conditions pertaining to receiving installations, which will have to do of course with the elimination of the overhead antenna.

The principle of his invention has been mentioned in the Dutch radio publication, *Radio Niews*, January issue, 1920. Instead of the antenna or loop, Mr. Vlug used two earth plates buried into the ground and placed at some distance from each other. The lead-ins from these two earth plates are connected for specially designed but yet simple receiving apparatus, equipt with one audion for low frequency amplification. Very little inductance is used and with this simple arrangement he is able to distinctly intercept the signals from radio stations in the Dutch East Indies, which are over 15,000 kilometers distant, a result which was not equaled even with the specially large antennae erected for the reception of these East Indian stations.

Several Dutch amateurs have experimented along similar lines but instead of using the earth plates previously mentioned have used the gas and the water pipes in their homes. These experiments also proved very successful and demonstrated that large means of inductances were not necessary. From this we would infer that the large inductance coils at present in use will soon be a thing of the past.

Mr. Vlug has proved with his invention that Mr. Tesla was right in saying that radio waves travel thru the earth and not thru the air, as he recently described so clearly in one of the issues of *Electrical Experimenter*. (*Continued on page* 582)

Two Hundred Meters and What It Means

By PIERRE H. BOUCHERON

IN a recent article the writer attempted to convey to the general radio amateur what may be called the ethical side of the game; that is, he tried to point out the necessity for applied common sense in reference to present day amateur operating conditions. At the same time he briefly outlined a constructive plan of action, hoping that a word to the wise was sufficient. Since then, however, notices from various parts of the United States and particularly from thickly populated radio traffic centers, such as New York, Philadelphia, Boston, New Orleans, San Francisco, Los Angeles, have been received, showing that a considerable number of amateurs are rather lax in the manner in which they tune their transmitters. Broadly speaking it would seem that the small number of ten out of every hundred transmitters are tuned on the happy and safe side of 200 meters. The average amateur transmission wavelengths seem to run nonchalantly from 250 to 375 meters. This condition is rather deplorable, as such excessive wavelengths are altogether too close to commercial and official traffic, and may eventually result in drastic laws *negative to the welfare of the amateur.* For this reason, let us indulge in a straight-from-the-shoulder talk. First, let us review some of the most important existing laws and regulations concerning amateur operation.

(a) General amateur stations are restricted to a transmitting wavelength *not exceeding* 200 *meters* and to a transformer input *not exceeding 1 k.w.*

(b) When within five nautical miles of a Naval or Military radio station, the transformer input is limited to but ½ k.w.

(c) A licensed first grade amateur must be able to receive at no less than ten words a minute, counting five letters to the word.

(d) At present local government radio inspectors frequently "listen-in" to the activities of amateurs and when they hear any one transmitting above the lawful wavelength of 200 meters immediately warn them if it is the first offense, or impose a fine of $25.00 on the second offense. When the Department of Commerce ruled 200 meters for amateur use, it *meant* 200 meters and not 300 to 400 as some seem to think. Watch your step, young gentlemen, and do not overstep the bounds of safety.

In erecting your aerial, remember that in order to secure effective transmission at 200 meters, its natural period must not be much over 160 meters. Do not expect to keep within the law if you *exceed* this limit. If you wish to experiment with long wave, long distance reception by all means do so, but do it on a *separate long wave receiving antenna.* The writer suggest that you carefully read articles which appear from time to time on antenna design and construction. Above all, be up to date upon this important subject.

There is an erroneous impression among some amateurs, who really ought to know better, that much greater distances can be covered by employing wavelengths above 200 meters. This is entirely wrong, for just as good results may be secured on 200 meters or less. The reason many amateurs do not find this so *lies with the receiver* and not the transmitter. Many amateurs design their receivers for long wave, long distance reception and few pay any attention to the efficient reception of 200 meter wavelengths. If a receiver is properly designed for *short wave reception,* making it possible for the operator to effectively *tune down* to 200 or 175 meters, he will discover that just as good results will be possible. Perhaps some of you do not know that dependable undampt transmission is now being accomplisht between New York and Boston amateurs on the comparatively low wavelengths of 150 and 175 meters *by the use of Vacuum tubes.* In view of this fact do not let anyone misguide you into the belief that much greater range can be obtained on 300 than on 200 meters.

It is a simple enough matter to tune your transmitter to the proper wavelength. There is nothing very complicated about a wave meter and a very effective one may be constructed without very much difficulty or expense providing, of course, it is properly and accurately calibrated at the start by the use of another one of standard calibration. If you do not care to trust some one else's home-made instrument, one may be purchased at a very reasonable figure. Write to any well known manufacturer and ask for price quotations. The advertising pages of RADIO AMATEUR NEWS are filled with reputable dealers, while text pages frequently give the construction and calibrating data on this important and valuable instrument. As a matter of fact, *every radio amateur* should possess a wave meter and should be proficient in its use. Employ it as often as the occasion seems to warrant it, for a slight alteration in your transmitting hook-up may change your wavelength considerably one way or the other. When you have increased or decreased the inductance or capacity of your oscillating circuit, do not resort to the time worn practise of calling your nearby friend and asking him for a correct estimate of your wavelength. He cannot give it to you unless he is equipt with well calibrated measuring instruments. At best, he will only *guess* at it. A very recent guess of this kind proved to be a *mere 100 meters* out of the proper and lawful amateur wave length of 200 meters. On the other hand do not overdo the tuning process by placing a "brick" on your transmitter key, as the saying goes, and try out all possible wavelengths on the scale.

Another important factor is that of sharp tuning; in other words, the primary circuit of your oscillatory system should be in resonance with the secondary or aerial circuit, which in general means a loose coupling (the degree of which is determined by the use of the wave meter) as distinguisht from close coupling. At the present day, there is altogether too much close coupling in amateur transmission; the obvious reason for this, of course, being the fact that one believes he may be heard more rapidly. Remember that there is only one lawful excuse for close coupling and it is one *not* to be used by amateurs. Its application is solely resorted to by vessels in distress and never at any other time. Under such conditions the ship operator tightens the coupling of his oscillatory circuit, producing high damping so that his distress signals may be heard over a wide receiving range.

Be reasonable. Surely the U. S. government is not imposing upon the American amateur when it limits the operating wavelength of your transmitter to 200 meters. Contrast this law to that of Canada, where the limit is placed at 50 *meters.* As a Canadian amateur recently remarked "With this short wave we may consider ourself fortunate indeed to cover the extraordinary distance of one mile!" As for democratic England, the would be amateur is simply "out of luck," for no license or permission is at present even obtainable under any condition. From the foregoing, we may therefore deduce the timely moral: *Keep your transmitter on the lawful side of 200 meters.*

New Form of Amplifier for Radiotelegraph Receiving Circuit

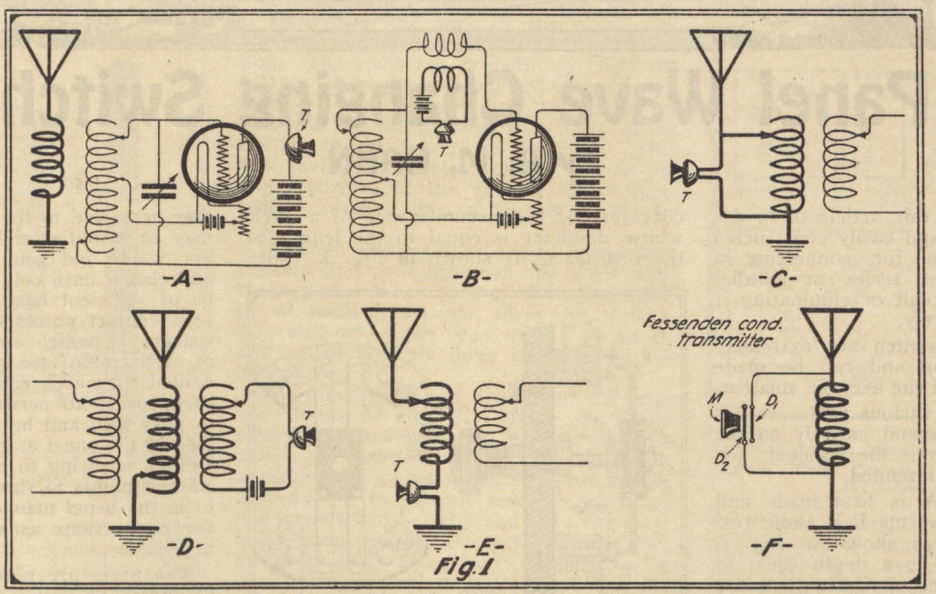
A STUDY of amplifiers for use in radiotelegraphy is in progress at the Bureau of Standards. Amplifiers are used to increase the intensity of signals, making it possible to hear very faint signals which formerly could not be received. Measurements are being made on the various amplifiers which have been developt for war use and special purposes. Work is also being done on the design of special amplifiers having the particular characteristics desirable for certain uses. Particular interest attaches to work which has recently been done on a combination audio and radio frequency amplifier. This utilizes four electron tubes in such a way that they are *equivalent to six tubes.* The tubes used are of the Signal Corps type VT-1, manufactured by the Western Electric Co. The first three tubes are used as radio frequency amplifiers; the fourth is used as a detector tube. A connection is then made to the second and third tubes which are *utilized again,* this time as audio-frequency amplifiers. In this way the second and third tubes are used twice and a saving is made in the number of tubes required and hence in the battery which is necessary in order to keep the filaments hot. This amplifier is constructed to be most sensitive for radio currents having a wavelength of 535 meters, altho the wavelength on which most efficient reception can be accomplisht may be made longer by a slight change in the construction of the transformers used in connection with the first three tubes. The amplifier is very simple to operate, there being only three, two of which regulate the current thru the filaments of the tubes, the other being a stabilizing rheostat. This amplifier will be used in connection with some tests of radio fog signalling apparatus for the Bureau of Lighthouses.

Editor's Note: Amateurs, attention. Keep in touch with the latest radio development. From the above just think of the advantages to be gained by utilizing four tubes and securing the results of six! The Bureau of Standards will bear close attention. Keep your radiographic ear to the ground!

Modulation Control In Radiophone Transmission

By PAUL R. NACHEMSON

THE problem of undistorted and clear modulation has without doubt been the most serious of all the troubles which have beset the now too carefree path of the radio telephone engineer. The magnitude of the task involved can only be appreciated when it is considered that the energy radiated in the form of sound in ordinary speech is prboably in the neighborhood of one billionth (0.0000-00001) of a watt. This infinitesimal force must be amplified in some cases *hundreds of billions of times,* reproducing the exceedingly complex variations of the human voice with the most minute exactitude.



In the Above Diagrams (A) Shows Plate Current Method of Modulation; (B) Grid Current Modulation; (C & D) Detuning Method of Modulation; (E) Antenna Current Modulation and With (F) Modulation Is Accomplisht by the Use of a Condenser Transmitter.

Fig. 1 presents a number of modulation systems, some in common use, but all having been successfully utilized at some time or another.

In the arrangement shown in A, Fig. 1, modulation is effected by the variations in the resistance offered to the passage of the plate current. This is known as the *plate voltage control system* or in the case of the arc radiophone as the *generator control system.* In diagram B an alternating electromotive force is *imprest on the grid.* This aids or retards the passage of the plate flow to a degree homologous to the fluctuations of the voice. The circuit shown at C is dependent on a *detuning action by the microphone* and also on the effect of the *absorption of transmitted energy.* The Fessenden condenser transmitter shown in F is particularly well adapted to this circuit. The action of such a transmitter is as follows:

When the voice impinges on diaphragm D_1, it alters its position in respect to that of the diaphragm D_2, thus varying the normal capacity of the instrument. The amount in variation is wholly dependent on the intensity of the voice, while the rapidity of vibration corresponds to the pitch of the voice.

A similar system to that shown at C is presented at D. Here the transmitter is *inductively coupled* to the antenna inductance. The circuit shown at E is perhaps the one most commonly employed by experimenters. Here the microphone acts as a *variable resistance* to the emitted energy.

Let us consider the employment of such units as are here described in an arc transmitter. Here we encounter the difficulty of preventing packing of the carbon granules, due to the heat generated by the heavy current of the arc.

The ordinary microphone, having a resistance of from 50 to 100 ohms, can absorb no more than 2 watts. Above this a frying or crackling noise will be heard in the receiver, the carbon grains of the transmitter will overheat, and the instrument will gradually deteriorate.

We can eliminate this difficulty to a great extent by using a number of microphones in *parallel,* a Marzi high current microphone, or a liquid microphone such as the Chambers, Vanni or Majorana. But each of these has its limitations and drawbacks. The liquid transmitters are essentially cumbersome and inconvenient, while the multiple transmitters are costly and imperfect at best, since there is a tendency for one unit to receive a slightly greater current than the others, and once this occurs the resistance of this one microphone drops in proportion to the increase in current and soon the entire current flow passes thru it with the result that it overheats and clear articulation is destroyed.

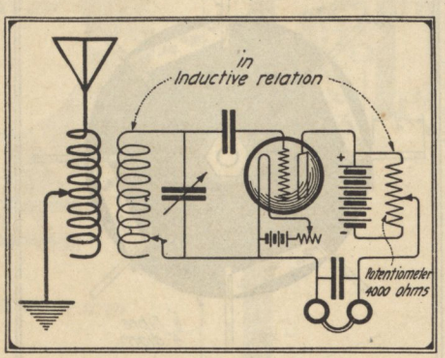
It follows then that the systems shown in Fig. 1 at B and D are to be recommended, for here the functions of the microphone are performed in an extraneous circuit and at a *low current.* We might include that system shown at C provided that the Fessenden condenser transmitter shown at F were utilized.

An Unexpected Circuit

By H. K. DUNN

AS I was experimenting with my receiving set recently I discovered a curious effect which might well be called a new method of amplification. At any rate it was new to me, and I have not takled with any one who has experienced the same thing, nor have I seen any mention of it in books or magazines.

I was using a Marconi VT, with the ordinary audion circuit for the reception of dampt waves—a circuit that is not supposed to be regenerative or oscillatory in any way. I had fixt up a potentiometer for my B battery by stretching a German silver wire a number of times across a window above the operating table, and so could vary the voltage by sliding a contact along this wire. I was trying to find the best voltage to use, when I accidentally discovered that the circuit was regenerative; for when I moved the contact close to a certain point on the potentiometer wire, the incoming signals became suddenly louder, just as they do when a tickler is brought close to the secondary of a receiving transformer. I soon found that it was really a regenerative action, and not merely the point of best voltage, for when I moved the contact still farther in the same direction, the tube began oscillating. These oscillations were at an audio frefrequency, or in other words, the tube "howled." The probable reason for this behavior in the simple circuit is that the potentiometer wires were in inductive or capacitive relation to the antenna, and so the oscillations of the plate circuit were forced back on the grid.



In the Original Hook-up of the Author the 4,000 Ohm Potentiometer Was Accidentally Placed in Inductive Relation to the Secondary of the Loose Coupler.

Although these effects surprised me because I was not looking for them in the circuit I was using there is nothing new about them and they can be easily obtained by using the proper circuits. It was another phenomenon that surprised me most; for I found that when I adjusted the contact carefully to a point just below that where the tube would give a continuous howl, it would still howl with the dots and dashes of incoming wireless signals. That is, instead of the comparatively weak signals of the sending station I would hear the loud howl of the bulb. *The signals were thus amplified many times,* and were

(*Continued on page* 579)

Panel Wave Changing Switch

By A. M. HAHN

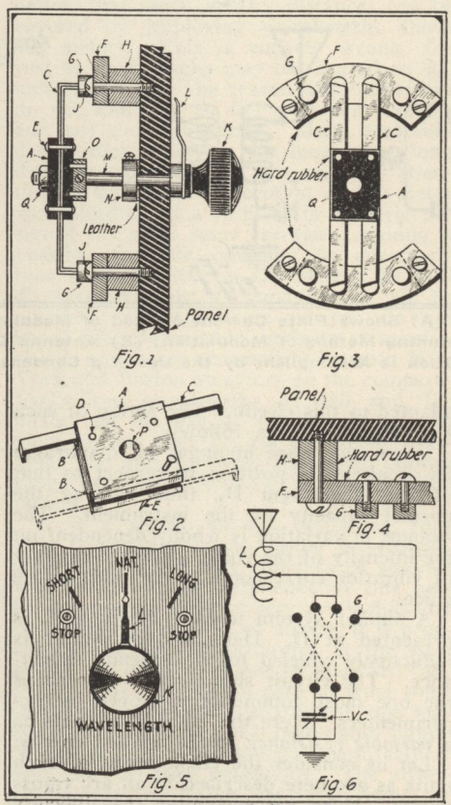
THE purpose of this article is to describe a simple and easily constructed concealed switch for connecting a variable condenser in series or parallel with the antennae circuit or eliminating it from the circuit entirely.

The parts of the switch are extremely simple in construction and can be made from the scrap box of the average amateur.

Dimensions of the various parts are not given as they will depend entirely on the available space within the cabinet for which the switch is intended.

The brush block A is first made and provided with the saw cuts B-B along two of its parallel sides as shown in Fig. 2. These cuts are made to a depth equal to the width of the brushes C-C which are made from thin sheet spring copper cut to the desired width and length and preferably built up to form a laminated switch to fill the saw cuts B-B. The small holes D are now drilled thru the block and brushes and an ordinary heavy straight pin such as shown at E is inserted thru until the head is flush with the block. The other end of the pin is then cut off about 1/16 of an inch from the surface of the under side of the block and riveted down, thereby securing the brushes in the block. An equal distance is now measured off from each end of the brush block along each of the brushes where they are to be cut, and then with the aid of a pair of pliers bend over a quarter of an inch of the ends at right angles to form the edgewise contact. The contact edges should now be smoothed up with a fine file and the corners slightly rounded so as to give a smooth wiping action when moving over the contact points.

The contact supports F-F should next be gotten out and are also made from hard rubber. These pieces should have the curvature of the circumference of a circle whose diameter is equal to the length of the brushes as is shown in Fig. 3. They may be sawed to the desired shape or they may be sawed straight and then soaked in hot water and bent to the desired shape and clampt until cold and set. They should be of sufficient length to permit mounting four contact points G intermediate of the spacers H which space the supports F-F at each end of the panel. A hole is next drilled thru each end of each support and each spacer to permit a machine screw J to pass thru and be threaded into the rear side of the panel as shown in Figs. 1 and 4. Before screwing to the panel, however, the contact points G should be fastened thereto in the usual manner and wires taken off for connections as shown in the diagram in Fig. 6.



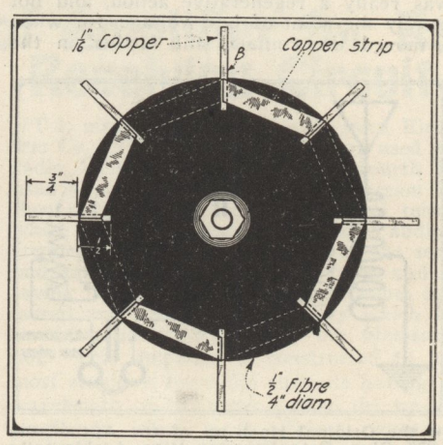
Here Are Six Views of the Construction Details as Well as Wiring Diagram of This Excellent Little Wave Changing Switch.

The parts are now ready for mounting as shown in Fig. 1, wherein K represents any type of switch handle having a pointer L and an extension rod M projecting thru the rear side of the panel. A leather washer is interposed between the rear side of the panel and the lock bushing N. The lock bushing O should have two small holes drilled at diametrically opposite points as indicated in dotted lines in Fig. 1, and two small pins inset therein so as to project into corresponding holes in the brush block. This prevents the block from turning on the rod M. The rod should project thru a suitable hole P in the center of the block, care being taken that the rod does not make contact with the two brushes. A nut Q is then threaded onto the end of the rod to prevent the block from becoming disengaged.

The front side of the panel should be marked off as shown in Fig. 5 in order to show when the proper contacts are engaged. Suitable stops may be mounted to limit the rotation of the switch in each direction.

An Easily Made Spark Gap Rotor

AN easy and comparatively cheap way of making a spark gap rotor is one which all amateurs are looking for. I present herewith a new idea, and as I have tried it out I know that it is worth while. A circular piece of fiber or hard rubber about 4 inches in diameter and ½ inch thick is used as the rotor proper. It may be mounted on the shaft of the motor in any way desired. For an eight point rotor eight slots are cut with a hack-saw ½ inch deep in the piece of fiber, as shown in the drawing. Any number of points may be mounted but the slots always have to be placed equidistantly around the outside of the rotor. Then take eight pieces of copper strip 1¼ inches long, ½ inch wide and 1/16 inch thick and drive them in the slots. Connection between the points is made with a ¼-inch copper ribbon which is wedged in the slots with the copper strip as shown.



The Circular Disc Used Here May Be In the Form of An Ordinary Phonograph Disc of the Small Type.

Of course, everyone knows that the ideal gap to have in these days of efficiency is a 500 cycle motor-generator and quenched gap set. The quench gap gives excellent results, is practically silent and due to its operating characteristics reduces damping and therefore decrement. However, it is not every amateur who can secure or can afford a set of this type, so the next best thing to do is to equip yourself with a rotary gap similar to this type or any other type which will give desired results. The old-fashioned straight gap will soon be in the discard. Amateurs, be up to date!

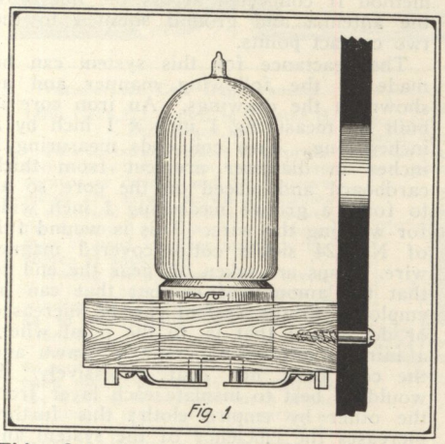
Contributed by EUGENE H. RIEL.

Ed. Note: Quite right! But then we must reckon on another consideration, which is that in a few years the amateur radio art will have advanced to Vacuum Tube transmission with buzzer modulation.

Economical Mounting for Vacuum Tubes

By C. H. BIRON

THE ultimate working efficiency of all radio apparatus is largely dependent upon the simplicity of the original mechanical arrangement. This condition



This Cut Shows the Completed Socket Mounted On Back of Panel.

is noticeable in receiving cabinets where vacuum valve operation demands simple and well arranged wiring. It follows that any impediment to mechanical simplicity has its result in an unnecessary length and number of leads as well as the constant introduction of minor obstacles thruout the design of the set.

Sockets, as now supplied for use with the four-pronged vacuum tubes, require an additional sub-base or shelf for cabinet use. This article describes the construction of vacuum tube sockets that overcome this objection as well as provide a homemade design so economical to build that any amateur may have plenty of spare sockets about for experimental use and for the elimination of switching as in the case of independent long and short wave sets by transferring a tube from one socket to another.

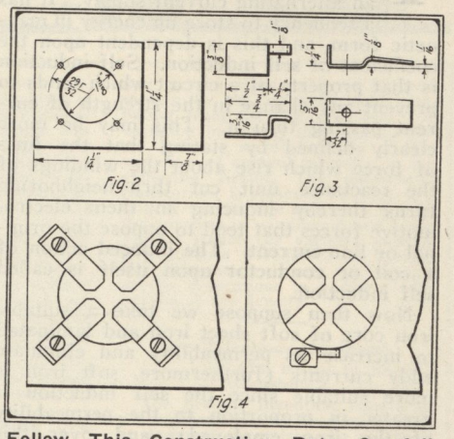
The completed socket is shown in Fig. 1, secured to the back of the panel with the tube in the recommended vertical position. The leads are brought up from the balance of the set and soldered to the spring members that provide lugs turned up at one end for the purpose and make direct contact to the prongs of the tube. This fact favors the locating of the tube in the upper portion of the cabinet where it is readily reached thru a hinged lid in the top.

Common practise has been to locate condensers and grid leaks on the shelf with the sockets. Since both of these are capable of small dimensions, *their logical location will be on the body of the socket itself* which presents three broad faces for this purpose.

The dimensions and drilling of the body are shown in Fig. 2. Maple is recommended for material, and when well dried will require no further treatment as far as insulative qualities are concerned. The best procedure is to lay out several sockets on one large board or strip and have the large holes bored out in a wood working shop to insure their being vertical and true to size. Use a small drill to locate for the wood screws that hold the contact strips to the under side as well as the locking lug on top. Drilling for the mounting screws should be located from the holes in the panel when ready to assemble. These latter screws must be capable of withstanding the strain imposed by the insertion and removal of tubes.

In Fig. 3 are detailed the contact strips and the locking lug. The former are of light but springy material; no advantage being obtained in material over 1/64th inch thick, as the combined pressure of the four springs bears directly upon the locking lug, which obviously should be of heavier stock.

Both should be drilled as shown with a hole suitable to the particular size of wood screw used. Care should be used in soldering the leads that the solder does not catch



Follow This Construction Data Carefully for Good Results.

the screw, leaving it free to be tightened in the event of future loosening.

If the sockets are drilled in a group as previously mentioned, they can be cut apart or arranged for multiple mounting as needed. The simplicity of such a mount is apparent in Fig. 4. This method is well fitted for amplifiers and radiophone transmitters.

To avoid confusion the contacts should be identified and marked according to the following, that is when looking at the socket as in Fig. 1, facing the locking lug or bayonet catch. Of the near or forward contacts the one on the right is for the grid and the one on the left is for the plate. The remaining or farthest pair of contacts are for filament battery connections.

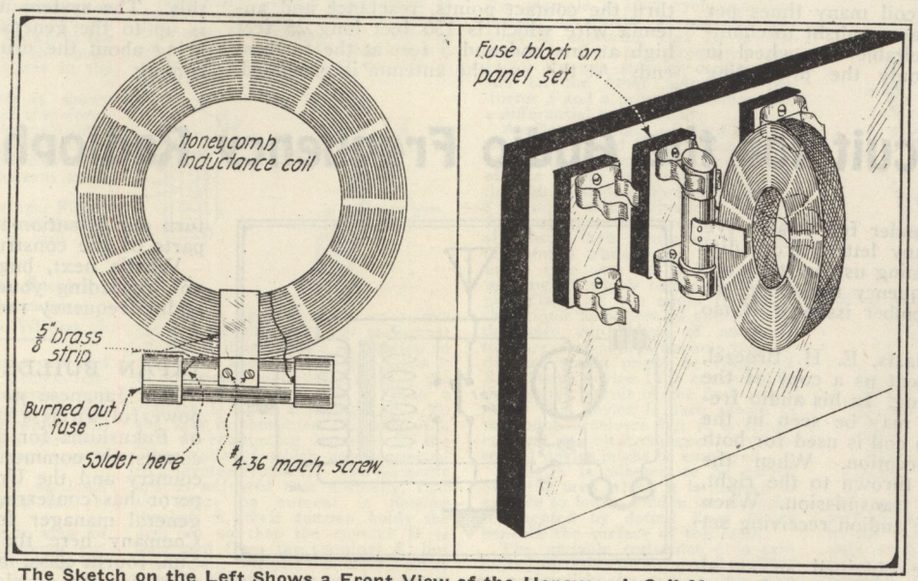
A Unique Mounting for Honeycomb Coils

By CHESTER W. WARD

HERE is a very good method of employing a certain electrical appliance which, when it has fulfilled its purpose to the point of burning out, can be immediately resurrected from the scrap heap by the amateur and made to earn its initial cost by many times. That appliance is the cartridge type blown-out fuse. Most any amateur will readily find a few lying around for this purpose.

Many of us who cannot afford to purchase the mounted honeycomb coils outright will welcome this idea, for all that is then necessary is to secure the unmounted form of the coils which, of course, are rather less expensive, and having done so may then proceed as follows:

The materials needed are, briefly: Three porcelain fuse blocks of the N.E.E. Standard type, as many *blown out* fuses adaptable to the above blocks as you may have honeycomb coils to mount, four ¼" No. 4/36 machine screws for each coil and 1½" of ⅝" wide sheet brass No. 18 gage. Take the brass strip mentioned and bend it around the inside of the honeycomb coil so that it will fit snugly on the fuse; then drill the necessary holes thru the brass strip and also thru the fuses, tapping the latter with a 4/36" tap. After this insert the screws but make sure these do not touch each other, otherwise the brass may act as a secondary loop and thus decrease the efficiency of the receiver.



The Sketch on the Left Shows a Front View of the Honeycomb Coil Mounted on the Fuse Proper, While the Sketch on the Right Shows One of the Coils and Its Fuse Mounting Plugged Into One of the Fuse Blocks. Not a Bad Idea, Eh, Boys.

The next step is to take the two leads from the honeycomb coil and solder each one respectively to each brass cap of the fuse. This soldering should preferably be done at the very end of the cap and in such a position as to be remote from the contact when the fuse is plugged into the block. After this mount the fuse blocks on the panel of your receiving set and presto! You will find that the coils and their effective adapters will fit into the clips quite securely.

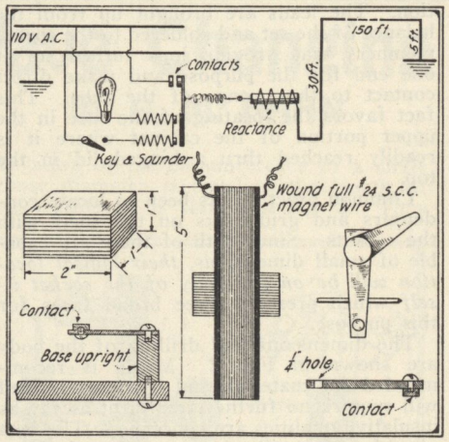
New Reactance Transmitter

By E. T. JONES, I. R. E.

THE average reader is more or less familiar with the performance of reactance units when shunted across an alternating current supply. It has a tendency to store up energy in magnetic form, and this is dependent upon the coefficient of self induction. Self induction is that property of a circuit which tends to prevent any change in the strength of current passing thru it. This may be more clearly defined by stating that the lines of force which rise about the windings of the reactance unit cut thru neighboring turns thereby inducing in them electromotive forces that tend to oppose the original or line current. The induced action of a coil or conductor upon itself is called self induction.

Now then suppose we take a suitable iron core of soft sheet iron and laminated to increase its permeability and eliminate eddy currents (furthermore, soft iron is more suitable since the self induction is greater in proportion to the permeability of the iron employed), and over this wind a considerable number of turns of fairly large wire. When an alternating current is applied to this coil, let us say in series, it shall endeavor to store up the current and regulate the flow to the adjoining circuit. We will then consider the coil as having stored up considerable current and we break the connection leading to it. There will be a momentary, extremely high voltage surge across this break, due to the current stored up therein and termed the counter-electromotive force of self induction. It is this high voltage surge which is employed in this system for the purpose of exciting the antenna and transmitting radio telegraphic waves. It must be remembered that the counter-electromotive force or self induction produces no loss of energy in an electric circuit, but a much higher voltage is required to force a given value of current thru that circuit. From the foregoing it can be readily understood that the energy which we are employing to transmit with is of no greater drain on the line; and it has been found from extensive experimental tests that this system requires only from one to two amperes to cover five miles with an ordinary amateur antenna installation.

We can then understand that in order to produce dots and dashes by this means we must provide some method to break the current from the coil many times per second. This can be accomplisht mechanically by rotating a suitable cog wheel in mercury, permitting only the protruding ends of the wheel to dip into the mercury. For various reasons this and many other such arrangements are not practical. For this purpose the author employs



These Are the Necessary Construction Details for the Reactance Transmitter.

an ordinary telegraph sounder. It is well known that when a sounder is connected to an alternating current supply in series with a 16 C.P. lamp that the armature or lever of same will vibrate, the number of vibrations depending upon the frequency of the current and the adjustment of the lever. On the arm of the sounder (previously referred to as lever or armature) a suitable contact point is made secure, and directly under its farthest end another contact point is placed upon some good support. These two contact points are so mounted or situated that when the arm vibrates in accordance with the current and adjustment of the sounder, contact is made and broken at every up and down stroke of the lever. This of course permits us to connect our telegraph key in series with the lamp, current and magnet coils of the sounder, forming the dots and dashes by controlling the current thru the sounder windings.

By referring to the circuit diagram of connections it can be seen that instead of shunting the reactance directly across the line, it is in series with the ungrounded side of the line and completes its circuit thru the contact points, reactance and antenna wire which is 150 feet long 25 feet high at one end and 5 feet at the farthest end. At this end the antenna is grounded, completing the circuit for the current thru the reactance. This method seems to have quite an advantage over the ordinary method if connected across the line with the antenna and ground shunted to the two contact points.

The reactance for this system can be made in the following manner and as shown in the drawings. An iron core is built up measuring 1 inch x 1 inch by 2 inches long. Two coil ends measuring 5 inches in diameter are cut from thick cardboard and placed on the core so as to form a groove measuring 1 inch wide for winding the wire. This is wound full of No. 24 single cotton-covered magnet wire. Taps are taken off near the end so that the amount of current that can be employed in the system can be increased or decreased; that is, to the point where a fair amount of amperage is drawn and the coil does not heat excessively. It would be best to insulate each layer from the other by empire cloth; this further increases the efficiency of the system and insures against breakdowns in the adjoining layers from the higher momentary surges.

Larger coils drawing much more current than this one could be constructed with larger wire. However, this coil will draw from two to four amperes if not tapt too near the beginning of the winding and is considered reasonable for the average experimenter's pocketbook allowances for "juice" for operation by the month.

A condenser connected across the contact points of the circuit tends to cut down the effective distance this set can transmit. Furthermore, it has been found impossible to obtain fair radiation with a condenser and inductance shunting the break inductively coupled to the ordinary open circuit.

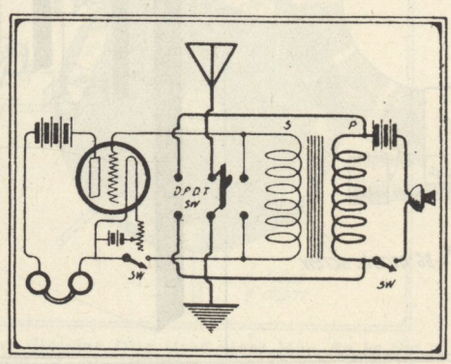
A caution in regards to this system is given herewith; never employ this set with a large antenna; that is, one with a natural period over 200 meters, as then you are not keeping within the law. It is best to employ very low wavelengths and make use of the audion detector and a short wave receiver built for this special purpose. If you can employ the system outlined, in a city where there are several commercial and naval stations, on very low wavelengths and thereby eliminate the interference of commercial traffic, you can claim to have accomplisht something worth while. Let us see what you can do with this. The system is in its infancy and it is up to the general mass of amateurs to bring about the usual improvements forthcoming.

Circuit for the Audio Frequency Radiophone

AT last things are under full sway. We have received many letters from different amateurs informing us that they are building an audio frequency radiophone as described in the November issue of RADIO AMATEUR NEWS.

One of the enthusiasts, E. H. Broezel, of San Diego, Cal., sent us a copy of the circuit which he is using. In his audio frequency apparatus, as may be seen in the diagram, the induction coil is used for both transmission and reception. When the double-pole switch is thrown to the right, the set is ready for transmission. When thrown to the left, the audion receiving set is connected.

Now that we have obtained an aerial switch which permits ease of transferring from transmitting to receiving, we should



In This Circuit the Spark Coil Transformer Is Used for Either Receiving or Transmitting.

turn our attention toward improving other parts of the construction and circuit.

What's next, bugs? Let us hear from you regarding your experiments with the audio frequency radiophone.

JAPAN BUILDS NEW WIRELESS.

The Japanese government is erecting a powerful wireless station in the prefecture of Fukushima for the purpose of relieving congested communications between this country and the United States. The Emperor has conferred upon John R. Geary, general manager for the General Electric Company here the Order of the Rising Sun, fourth class, in recognition of his services for the development of Japan's electrical industries.

Transformer Coil Improvement.

(No. 1,326,223, issued to Chester H. Thordarson.)

This invention relates to improvements in windings for magnetic apparatus or devices and the improvements are herein shown as adapted to electrical transformers. However, the improved winding herein shown may be used in other magnetic machines or apparatus.

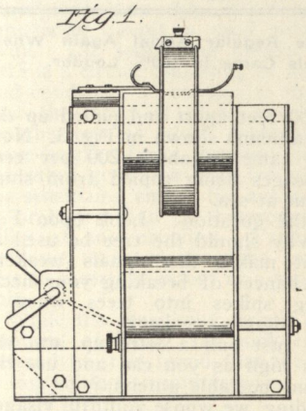
Among the purposes of the invention is to provide a novel form of winding so constructed and arranged as to structurally strengthen the winding.

Another object of the invention is to provide an improved constricting band which surrounds or encircles the winding to hold the turns of the winding in place, and also serves as one end of the winding or coil to which is attached a circuit wire.

A further object of the invention is to provide an encircling band of this character so constructed as to avoid corona discharge at the edges of the encircling band and across the coil.

Another object of the invention is to provide means for supporting the inner turns of the conductors forming the winding or coil, constructed with means to force the sup-

Fig. 1.



porting member outwardly against the inner turns of the coil.

Other objects of the invention are to simplify and improve windings of the character described, and further to adapt such windings to high tension transformers, and the invention consists in the combination and arrangement of the parts shown in the drawings and described in the specification, and as pointed out in the appended claims.

The present invention is shown as applied to that type of transformer illustrated in the inventor's prior application for U. S. Letters Patent, Serial No. 129,779, filed November 6, 1916, of which the present application is a division.

As shown in the drawings, Figure 1 is a side elevation of a transformer embracing a winding or coil embodying the invention.

Improvements in Radio Receiving and Recording Apparatus.

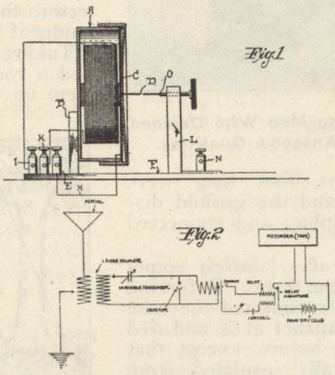
(No. 1,331,098, issued to William G. H. Finch.)

This invention relates to new and useful improvements in wireless telegraphic recording apparatus, and consists of a simple and efficient means of this character which will record wireless messages for any distances for which the apparatus is designed.

Figure 1 is a central sectional view through the receiving and recording apparatus, and

Fig. 2 is a diagrammatic view of a wireless telegraph receiving circuit, in connection with which the apparatus is used.

Reference now being had to the details of the drawings by letters: A designates a 3000 ohm receiver mounted upon a suitable support B, and C is a diaphragm forming a part of the receiver and which has a contact point D projecting centrally



therefrom and thru an opening in the receiver. A binding post E mounted upon the base F has electrical connections H with the diaphragm, and other binding posts, designated respectively by letters I and K, have electrical connections with the windings of the electromagnet receiver. A post L rising from the base and to which a binding post N is connected, supports an adjustable contact point O.

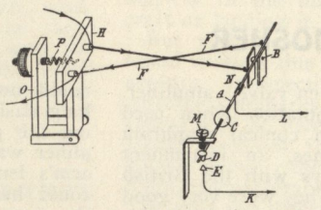
In operation, when the apparatus is connected in a detector circuit, as shown in Fig. 2 of the drawings, incoming signals or electrical impulses, will cause the electro-magnet of the receiver to become energized and the diaphragm being attracted thereby, will cause the contacts D and O to make and break according to the length of the received impulses, thereby opening and closing the local relay circuit and causing the armature of the relay to make and break circuit, according to the length of received impulses upon a tape recorder.

By the provision of a switch in the relay circuit the latter may be opened when not in use, thereby saving battery energy.

Improvements in Relays.

(No. 1,329,756, issued to Harry Alexander Ewen.)

The object of this invention is to provide a relay depending for its action upon the extension of a filament or filaments due to the heating produced by the passage of an electric current.



A is an arm mounted on a fixt pivot B so that the only movement of which it is capable is rotation in one plane about this pivot. Upon it is adjustably mounted a mass C the weight of which tends to keep a contact D upon a terminal E. To the arm is connected the ends of a pair of conducting filaments F, the other ends of which are connected to a pivoted frame H. The filaments are so adjusted that normally, that is, when no current is flowing through it, their tension holds the arm up so that the contact D is separated from the terminal E, but when an electric current flows through the filament and heats it it expands and allows the contact D to come into contact with the terminal E and thus complete an electric circuit between wires K, L connected to the terminal E and to the arm respectively. M is an adjustable stop limiting the upward movement of the contact D. N is a sleeve insulating the part of the arm connected to the filament from the part carrying the contact D.

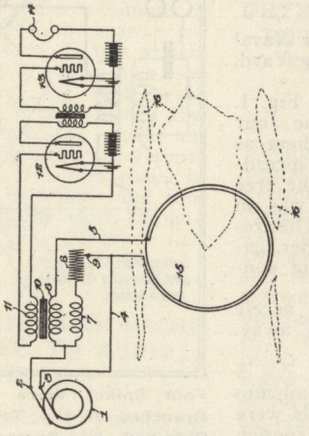
The pair of filaments F cross and almost touch, this being the position of greatest sensitiveness. In other words, the frame H has been turned relatively to the arm through an angle of from 150° to 180° from the position in which the two filaments are parallel. The frame H is hinged to a support O toward which the frame is drawn for purposes of adjustment by a nut I and a spring P.

New Means for Locating Ore Bodies by Audio-Frequency Currents.

(No. 1,325,554, issued to Wendell L. Carlson and Earl C. Hanson.)

The object of this invention is to provide simple and reliable electrical means for accurately spotting metallic ore deposits and indicating directly the extent of the ore bodies.

Referring particularly to the drawing which has been selected to clearly set forth the principle advanced in the present means for locating ore bodies, reference character 1 designates an audio frequency generator,



for example a 1000 cycle machine, having terminals 2 and 3. The portable exploring coil 15 is connected to the audio frequency generator on one side by conductor 4 and on the other side thru conductor 5 and a primary winding 6 of a differential transformer.

A second primary winding 7 of the same differential transformer is connected in a circuit from terminal 2 of the audio frequency alternator through variable calibrated resistance 8 equipt with adjustable contact 9, returning to the terminal 3 of the alternator thru conductor 4. The differential transformer has a laminated iron core 10 and secondary winding 11 which comprises the input circuit of the audio frequency thermionic amplifiers 12 and 13. Altho only two stages of amplification are shown it is obvious that additional stages might be employed. Responsive device 14 is connected in the output circuit of the final amplifier. This device is here shown as telephone receivers but it is apparent that any electromagnetically controlled device might be employed.

Coil 15 is adapted to be moved over the area which it is desired to explore to locate hidden ore deposits represented by dotted lines 16 as beneath the surface of the earth.

The variable resistance 8 is calibrated in terms of ore density. This is accomplisht by noting the relative energy absorbed by ore bodies due to the eddy currents induced therein by the magnetic field emanating from the exploring coil. A variation in energy absorbed by the ore body is accomplisht by a like variation of current intensity in the exploring circuit. The differential transformer is balanced for each setting by varying the resistance 8 until the currents in windings 6 and 7 are equal. Hence the variable amount of resistance 8 required to balance the differential circuits for various energy absorptions is a direct calibration of ore density.

New Telephone Headband.

(No. 1,329,658, issued to Hugo Gernsback.)

The present invention relates to a simplified style of headband which is designed to replace the old style double spring headband, and which embodies novel features of construction whereby it can be easily and quickly adjusted to fit the head with accuracy, and can be worn without any discomfort.

Figure 1 is a perspective view of a telephone headband constructed in accordance with the invention.

Fig. 2 is an enlarged sectional view through the compression chuck at one end of the headband.

Fig. 3 is a horizontal sectional view through the same.

Specifically describing the present embodiment of the invention, the numeral 1 designates an arched strip of resilient wire which is suitably curved to fit over the top of the head in the usual manner. This wire strip 1 is round in cross section, and the downwardly extending ends thereof are offset outwardly at 1^a. The use of round wire simplifies the construction and decreases the cost of manufacture. A pad 2 of some soft flexible material such as soft rubber is applied to the top of the headband 1, being adapted to be interposed between the headband and the head of the wearer. This pad 2 is shown as having a substantially elliptical shape, and is preferably of uniform thickness, being secured to the headband 1 by means of a pair of transverse strips or keepers 3 which extend across the top of the pad at points near the ends thereof

Fig. 1.

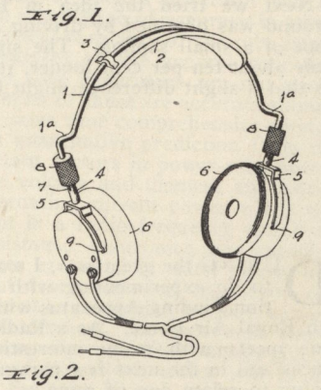


Fig. 2.

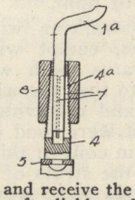
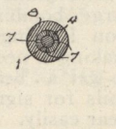


Fig. 3.



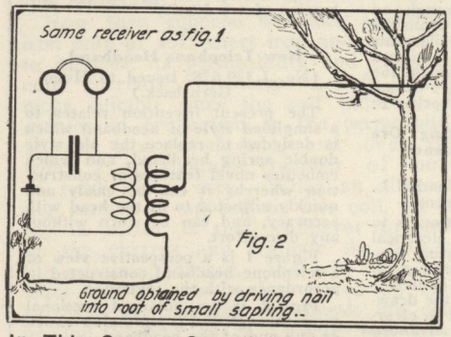
and receive the wire headband. This soft pliable pad will readily conform to the shape of the head, and not only enables the headband to be worn without discomfort, but also prevents any metal from touching the top of the head.

What's Wrong With The Trees?

By STANLEY E. HYDE

SO much has been said of late concerning the wonderful "antenna effect" of live trees that the writer started out one fine afternoon with a number of Radio Bugs, a portable receiver and several coils of insulated wire, etc.

We fully expected to bring home copies of messages from Berlin, South America and Oshkosh, Wis., but, yes . . . but! Everything was ideal. The place was Berkeley, Calif.; the spot was "Cragmont," some 500 feet above San Francisco Bay. The tree was a tall eucalyptus fully 100 feet high with four branches covered plentifully with gree leaves. Ten miles away was a 10 K.W. Naval Radio Station. Thirty



In This Case a Ground Was Obtained by Driving a Nail Into the Root of a Small Sapling.

miles further up the bay was another Naval Radio Station at Mare Island Navy Yard, NPG.

First we tried the experiment in Fig. 1. Four spikes were driven into the four branches and leads connected to them as shown. A ground was obtained by spreading insulated copper wires under the tree as shown at foot of tree. This was in effect a "counterpoise" ground. The receiver consisted of tuning transformer, galena and Perikon detectors, stopping condenser and sensitive telephones.

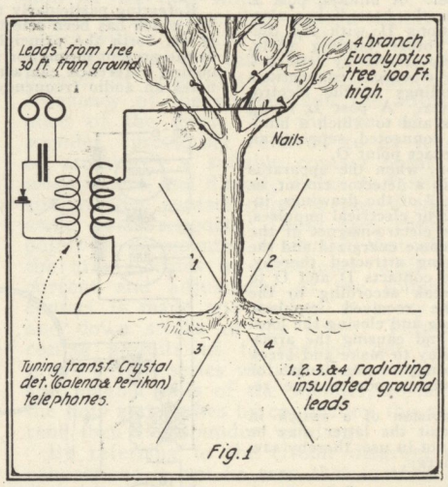
By *straining the ears* one could *barely* hear the naval station ten miles away. What was wrong with the tree?

Next we tried the idea in Fig. 2. A ground was obtained by driving a nail into root of a small sapling. The signals were only about ten per cent louder, just enough so that a slight difference might be noticed.

Here Are the Four Young Men Who Decided to Investigate Tree Antenna Qualities.

Three iron spikes one foot long were driven into the earth and the ground disconnected from the sapling and connected to the spikes.

The signals were *weaker*. Surely something was wrong with the trees! Referring again to Fig. 2. We disconnected the wire connecting the four branches at X and tied it in same position as before, except that the wire was electrically insulated from the tree, the tree merely acting as a mast



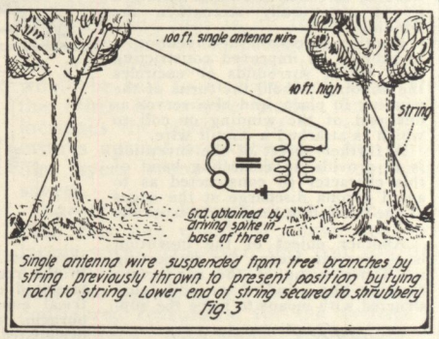
Four Spikes Were Driven Into the Four Branches of the Tree. The Ground Was Obtained by Spreading Insulated Copper Wires at the Foot of the Tree.

to hold up the wire.

With this arrangement the signals came in fully 50 per cent louder than when using the tree branches as an antenna, the wire being in the same position as stated above.

By this time our "Audion Bugs" are saying, "Why didn't they use a 20 step amplifier, tickler coil, etc.?" The point is this: If the signals came in 50 per cent louder when the lead was disconnected from the branches at X, Fig. 2, using a crystal detector, they would come in just so much louder if forty-eleven amplifiers were used.

Taking two long pieces of string we tied a rock on the end of each and threw them up into separate trees, about 40 feet


100 ft. single antenna wire
40 ft. high
String
Grd. obtained by driving spike in base of tree
Single antenna wire suspended from tree branches by string previously thrown to present position by tying rock to string. Lower end of string secured to shrubbery
Fig. 3

Back to the Regular Aerial Again Where Signals Came in 100% Louder.

high and 100 feet apart and pulled up the single wire antenna shown in Fig. 3. Now the signals came in about 200 per cent louder, messages being copied from ships 200 miles out at sea.

Here is the question: Look upon Fig. 2 again. Why should the tree be used at all when it makes the signals weaker? Why take chances of breaking your neck, or pounding spikes into trees when it makes your signals weaker?

Why not just pull a wire up into the branches as high as you can and use the good old-time portable antenna?

In concluding, we whose youthful visages appear in the photo do heartily and to the best of our knowledge declare that the "Talking Trees" for radiotelegraphic receiving purposes is not what it might be. Try the experiment out, yourselves, boys.

A Flying Tale of Radio

By R. T. MOSHER

DURING the great war, I was assigned to do experimenting with the Direction Finding Apparatus with the British Royal Air Force. As a Radio observer one meets with many interesting experiences and in the next few paragraphs I am going to relate one of mine.

The plane I was working with was a large bombing plane, equipt with Direction Finding Apparatus, both wing coils, making it necessary to turn the whole plane to get a "bearing," and revolving fuselage coils for signals that were loud enough to hear easily. The main coils of this set were wound vertically on the struts of the plane and the auxiliary coils were wound vertically around the top and bottom wings through a false strut, thus giving a large "area-turns" surface especially on the auxiliary coil. The Amplifier was one of the British War Department type, known as the Cranwell seven-valve amplifier, which had a good reputation when used with the S. G. Brown conical diaphram War Department phones, an instrument which all American boys with the British section liked so well. They were very good phones and the Yankees knew it—as many a Yank's barrack bag can prove! With this amplifier, the receiving of weak signals was an easy matter even with the small coil aerial on the plane.

Well, on this big day we were flying quite high near our field with the apparatus I have just described, when I caught a faint signal, and as it happened that we were right across the plane of the wave, I got it quite loud on the huge auxiliary coil. I soon tuned in and heard an unknown Beacon Station which we afterwards learned was quite near coming in with a series of "MA's." When I could not make out anything except the long dashes I took off my helmet containing the phones to see how well my amplifier was working. I held it forward at arm's length with all valves working and could hear the signals plainly even over the roar of the unmuffled engine, which exhausted right on the port side of the observer's cockpit.

This Beacon Station sent out a very peculiar buzz, each dash starting with the usual high pitch of a 500 cycle note and ending with a heavy, coarse Z-Z-Z, lower than 60 cycles.

As I held it out I could hear it just as well as if I had the phones on my ears. While I held it out for a couple of minutes I noticed the pilot looking around and acting uneasy.

All of a sudden I heard the motor

(*Continued on page* 586)

RADIO DIGEST

EFFECT OF VARYING THE CAPACITY-INDUCTANCE RATIO IN OSCILLATING RECEIVING TUBE CIRCUITS.

As the vacuum tube is a voltage operated detector of signals, it has been supposed that the sensibility will be greater, the greater the inductance capacity ratio in the grid circuit. It was reported in 1917 that the sensibility was independent of this ratio. Recent experiments made on Nauen with inductances varying from 2.5 mh. to 36 mh. again showed no change in sensibility, provided the local oscillations were kept at the optimum value. The telephone current appears to be proportional to the square root of the antenna watts.

HETERODYNE, AUTODYNE AND SENSITIZING CIRCUIT.

Commander A. H. Taylor and also Mr. Israel have found that for long waves the heterodyne with vacuum bulb is more sensitive than the autodyne. The explanation being that with the heterodyne the secondary can be set exactly on the signal wavelength, while with the autodyne it must be detuned to produce the beats.

In the Research Laboratory it has been found that there is no difference in sensibility, provided the optimum coupling between the primary and secondary is maintained in both cases. With a loose coupling as used by Commander A. H. Taylor, the signal with heterodyne is stronger unless a sensitizing circuit is used with the autodyne. The sensitizing circuit reported in 1915 is a circuit consisting of an inductance and condenser so coupled to the secondary that the latter is given two free wavelengths, one of which corresponds to the wave-length of the incoming signal, while the other gives the beat frequency. With the sensitizing circuit the autodyne is equal to or better than the heterodyne in sensibility at any coupling. Probably at the optimum main coupling the antenna itself acts to a certain extent as a sensitizing circuit.

While the sensitizing circuit has the advantage of being far simpler than the heterodyne it is found that the heterodyne is less subject to interference.

REGENERATION OF SPARK SIGNALS.

It has been suggested that possibly the strengthening of spark signals observed with the autodyne when the back coupling is closed to a point just before the note is roughened by the local oscillations may be due to very weak oscillations not strong enough to effect the note. Experiments have, therefore, been made with weak heterodyne coupling to see if the same phenomenon could be found as with the autodyne. No strengthening in the spark signal was observed until the note was roughened.—Abstracted from *Journal Washington Academy.*

THE WIRELESS EXPERIMENTER'S MANUAL.

By E. E. Bucher.

A volume containing three hundred pages with many valuable illustrations and photographs of apparatus, publisht by Wireless Press, Inc., New York City. This book is really a revised and enlarged edition of Mr. Bucher's former book "How to Conduct a Radio Club." The book is of a distinctive nature in that it comprehensively covers the designs of radio transmitters and receivers. This includes the construction of transformers, high voltage condensers, spark gaps of all types, aerials, masts, and complete receiving sets for long and short wavelength, all of which are described in very instructive detail, vacuum tube and Cascade amplification is also given attention as well as direction finders, underground aerials and static elimination. The amateur is instructed in simple language how to measure the inductance, capacity and resistance of his antenna and he is also shown how to check up the efficiency of his station. The book also contains useful information on the proper procedure for conducting a raido club. Generally speaking this book should prove of real value to the general amateur.

AMPLIFICATION OF VERY LOW FREQUENCY AND RESULTING OSCILLOGRAMS, AND THE APPLICATION OF THESE TWO FOR THE GRAPHIC RECORDING OF RADIO TELEGRAPH SIGNALS.

The principle of this method is as follows: Amplification of the signals is accomplisht at high frequencies, then at low frequencies. This latter frequency, however is very low, in fact it must be low enough to be of the same rhythm as the dots and dashes of the Morse signals. Several tubes of amplifiers are necessary in order to accomplish the final vacuum tube's function either completely or not at all, that is to say that the current on their respective plates passes a maximum value during the passage of the signals and a minimum or nil value during the interval or space separating the dots and dashes. In this system reception is accomplisht by means of a loop of sufficient inductance for high wave lengths, altho of course reception may also be accomplisht by means of the regular antenna. In this instance, however, preference is given to the loop, as it is then easier to secure most favorable directions and thus avoid signals transmitted by other stations. —*Abstracted from Revue Générale De L'Électricité.*

FOG TROUBLES AND THE RADIO COMPASS APPLIED TO AERIAL NAVIGATION.

Dense fog is the bugbear of present-day flying and represents practically the only climatic conditions which really trouble the pilot. The aeroplane as a machine is not prevented from flying by fog, but the pilot is practically rendered blind, and therefore helpless in the matter of navigating his craft or landing it.

But with a perfected system of directional wireless this difficulty practically disappears. Irrespective of mist or fog, or whether landmarks are visible or not, the course will be determined by the constant signals received from beacon stations at known points either on or off the line of flight, but preferably at the destination end. The pilot can detect instantly from the signals, especially if "homing" towards a beacon station, should he veer in any way from the set course, and is able to correct his line of flight accordingly.—*Abstracted from Wireless World for March.*

GENERATING SETS FOR LABORATORY USE.

The researches and tests in progress in the radio laboratory of the Bureau of Standards require the use of steady sources of alternating current of frequencies from 200 to 10,000,000 cycles per second. Several generating sets have been designed and constructed in which electron tubes and associated circuits are used to produce alternating current of the required frequency from a direct current power supply.

One of these generating sets having a wave length range of 30 to 50,000 meters (frequency range of 10,000,000 to 6,000 cycles) has been built up with a convenient control panel for use in standardizing wave meters and other radio apparatus.

Another generating circuit, for use in the study of insulating materials, is designed with special inductance coils and a special condenser with a scale which gives the power loss in the sample of insulating material directly, without any calculation.

Two low-power generating sets have been designed for portable use and are especially compact. An electron tube is also employed in a set for generating audio-frequency currents from 200 to 6,000 cycles, which is used for alternating-current measurements, studies of telephone receivers and other work at telephonic frequencies.

A special generating set for producing small measured voltages at radio frequencies of 200 to 4,000 meters wave lengths is used for measuring amplifiers and detectors. It is so arranged that the instruments which are being measured are completely shielded from both electrostatic and magnetic fields from the generating circuit, the coils of which are wound in a special way, the entire circuit being enclosed within a copper shield.

DETERMINATION OF THE OUTPUT CHARACTERISTICS OF ELECTRON TUBE GENERATORS.

By Louis M. Hull.

Within the last three years the experimental development of the three-electrode electron tube as a generator of alternating current has been carried out to such an extent that the device is at present the standard source of supply for radio telephone and telegraph circuits in all cases where extremely high power is not required. At the same time no adequate methods have been evolved whereby the efficiency and power output of such a generator can be stated with any degree of accuracy in terms of the electrical constants of the tube itself. Several analyses of the general operation of electron tube generators are not available. But none of these are accurate enough and at the same time comprehensive enough to allow a quantitative prediction from the two important factors in power-tube operation—plate voltage and filament emission—of the alternating current power which can be developt in a radio-frequency circuit of known resistance, inductance, and capacity. Power tubes are rated in watts output and watts input from empirical data upon circuits adjusted to particular settings, experimentally determined, for maximum power or maximum efficiency. Such ratings give no intimation of the power which will be developt by the tube if any constant of the output circuit be changed.—*Abstracted from Bureau of Standards Circular No.* 355.

RADIO ENGINEERING PRINCIPLES.

By Henri Lauer and Harry L. Brown.

A very good treatise for the general radio man publisht by the McGraw Hill Book Co., Inc., New York City. Special treatment is given the many applications of the Vacuum Tube.

Radio Club of America.

A very interesting meeting was held on March 26 by the Radio Club of America in Room 306 of the Engineering Building, Columbia University, New York City.

Mr. L. C. F. Horle, Expert Radio Aide, Navy Yard, Washington, D. C., who has charge of all receiving equipment of the United States Navy, gave the complete history of navy receiving apparatus from the beginning to the present stage of the art.

Among many of the amplifiers described was the new type amplifier specially designed for use in connection with the radio compass and which is equipt with three stages of radio frequency amplification, one detector and two stages of audio frequency amplification.

With this set Nauen signals were copied in a U. S. submarine submerged to a depth of 30 feet in Chesapeake Bay, employing a 2-foot loop. The Nauen signals were so loud that their intensity had to be lowered. An interesting observation in connection with this experiment was that static or strays, which were very noticeable while the submarine was on the surface of the water, practically disappeared after the underwater craft had submerged.

Mr. L. G. Pacent was chairman of the meeting owing to the temporary illness of Major Armstrong.

Discussions were heard by the following well-known radio experts: Mr. George A. Clark, formerly chief expert aid of the United States Navy and now chief receiving expert of the Radio Corporation of America; Captain Guy Hill, of the Signal Corps; Prof. Hazeltine; George Crouse, of the Radio Department of the Sperry Gyroscope Co.; Julius Weinberger, Research Engineer of the Radio Corporation of America, and Mr. F. Lowenstein, the well-known manufacturer of radio sets.

The next meeting of the club will be held on May 21. Prof. Hazeltine will read a paper on the theory, care and operation of the radiophone, as well as describe many circuits. This paper should prove very interesting to the average experimenters, many of whom have had considerable difficulty in making their radiophone oscillate on short wavelengths.

Potomac Radio Club.

Announcement is made to all radio amateurs in and near Washington, D. C., that a new radio club has been formed, known as the Potomac Radio Club of Washington, D. C. This club has been in operation since December 15, 1919, and has seven members to date. Lectures on radio and parts of radio sets are given each week by different members of the club. This proves very instructive and beneficial to all members. The officers of this club are: President, W. H. Cameron; vice-president, T. F. Cameron; secretary-treasurer, J. M. Hanlon, and assistant secretary-treasurer, Thomas Lipscomb.

If there are any persons interested in radio in the near vicinity of our club meeting place, which is 1327 Florida avenue, N.W., and are desirous of joining a radio club, please communicate with the secretary-treasurer, Joseph M. Hanlon, 1345 Florida avenue, N.W., Washington, D. C.

Piedmont Radio Club.

This is to announce the formation of the Piedmont Radio Club among wireless enthusiasts of Gaffney, S. C.

The organization was effected at a meeting called on February 2. Officers elected were as follows: Harris E. Gaffney, president; Louis C. Tolleson, vice-president; J. J. Brown, secretary; Tom Brown, treasurer. The membership of the club consists at present of nine, but anyone over fourteen years of age is eligible.

Two of the members expect to have half-kilowatt transmitters in operation by spring, while all have receiving stations. The object of the club is for the advancement of radio in this section, and for the future regulation of local traffic, which is sure to come. Interested persons communicate with H. E. Gaffney, Gaffney, S. C.

Tesla Radio Club.

The Tesla Radio Club of Geneseo has elected officers for the ensuing quarter as follows: Mr. Champ, president; Mr. Countryman, secretary; Mr. Doty, treasurer. The organization has been in existence a month, and at present has 15 members. Meetings are held every Monday in the Geneseo Normal School, whose talks are given by various members. A room is being fitted up and we are shortly to install a high power club set.

Mr. Champ, our president, worked wireless in France for two years, and recently gave an extremely interesting talk on his experiences. We are desirous of getting in communication with amateurs in Western New York. Please write, addressing the secretary, Gilbert Countryman, Secretary Tesla Radio Club, 42 Second Street, Geneseo, N. Y.

Louisville Radio Club Seeks Members.

Decision to begin a membership campaign at once and a talk by Prof. E. P. Chapin, principal Manual Training High School, on "Magnetic Lines of Force," featured the meeting of the Louisville Radio Club, 236 West Jefferson Street, recently. Forty members were present. It was announced that the radio set which is now being installed for exclusive use of members of the club will be completed within a month.

Atlanta Radio Club.

"Tuning of Radio Transmitters" was the topic of an instructive address delivered at the regular semi-monthly meeting recently of the Atlanta Radio Club by its president, H. E. Buffey. The meeting was held at the Y. M. C. A.

Other officers of the club are A. D. Whittaker, Jr., vice president, and R. B. Flowers, secretary. Anyone interested in wireless telegraphy, whether a member of the club or not, is invited to attend the meeting.

Radio Articles in April Issue Electrical Experimenter

1. *Some Long Distance Radio Telephone Tests—Full description of the apparatus used in talking* 1,500 *miles on less than* 300 *watts —Robert F. Gowen, Radio Engineer, de Forest T. & T. Co.*
2. *Music* 400 *miles by Radio.*
3. *New "Direct Current" Radio Transmitter.*
4. *Audions on Alternating Current Again!*
5. *Latest Radio News.*
6. *New Amateur Wireless Transmitting Set.*
7. *Selective Wireless Control—By means of special relay. By Everett Leo Deeter.*
8. *War Versus Pre-War Apparatus, by "Sparks," C. E., Radio, U. S. N.*
9. *Hello, Mars! Detailing various methods, including "Radio" for opening communication with Mars, by H. Winfield Secor.*

Wireless Club Formed.

Thirteen members of the new wireless club organized at the Rockford Boys' Club, Rockford, Ill., were enrolled at a meeting held recently. They are Leroy Monosmith, Francis Floren, Clifford Nelson, John Yurenas, Oswald Erickson, Harold Kegan, Mabin Hallen, Francis Smith, Seved Hendrickson, Theodore Paulson, Harry Sodergren, Arthur Eggleston and Stanley Datin. Orville Whisman has been selected as instructor. The class will meet each Monday night at 7:30 at the boys' club.

Bedford Wireless Association.

The first meeting of the Bedford Wireless Association was held recently in the radio room of the Bedford Y. M. C. A., Brooklyn, N. Y., with G. Johnson presiding. Two instructors have been secured, namely, Dr. Happe, an all-around radio man, and Mr. Bowie, formerly radio instructor in the United States Navy Radio School at Harvard University. It is planned to have the students visit the big navy radio and the wireless stations of the various newspapers.

The radio room of the association consists of a receiving set of 15,000 meters, and a sending set comprising a motor generator, one-half K.W. transformer, five Murdock condensers, a rotary gap and an oscillation transformer.

All those in the Bedford district who are interested in wireless and who would like to join the association should communicate with James Corcoran, secretary, of No. 420 Gates Avenue.

Savannah High School Radio.

The Savannah (Ga.) High School has the distinction, it was recently announced, of being the first high school in the United States to install a modern radio telephone station. As soon as it is inspected by the Government it will be put into regular operation, and is capable of picking up telephonic conversation from points practically all over the world, though it is stated communication can be established with points within a radius of only 200 miles. Savannah "Hi" boys will soon be talking with the big ships at sea off Tybee.

United Radio Telegraphers' Association.

It will probably be of interest to all radio men to know that the U. R. T. A. is now a national organization.

Mr. Benjamin Beckerman, long president of the New York branch of the U. R. T. A., has been elected to fill the office of National President. Representatives of the New York and New Orleans branches attended the convention.

Charters will be granted in the immediate future and an amicable agreement will be reached with the Association on the west coast.

Address any possible communications to the Secretary at 44 Broad Street, New York City.

The "Tech" Radio Club.

The "Tech" Radio Club was organized at the Oakland Technical High School on October 23, 1919, with Mr. Coleman of the Science Department as advisor. At the present time the club boasts of 35 members and many things have been accomplisht.

In order to secure an efficient transmitting set as well as a receiving set, the club gave a moving picture show in the school auditorium. The profits from this show were sufficient to pay for a 2 K.W. transmitting set.

The club visited in a body the Government radio station on "Goat" Island in San Francisco Bay recently, where the members of the club were most cordially treated by operators in charge. There have also been numerous lectures given by experienced radio men. The club is anxious to get into communication with other nearby Radio Clubs. Address all communications to the Secretary, J. N. Spaulding, 4191 Opal Street, Oakland, California.

The South Hills High School Radio Club.

The South Hills High School Radio Club has been organized with a membership of thirty. The president of the club is Mr. McCausaland, who deserves this office. Other officers are: Mr. Jones, vice president; Mr. Worchester, treasurer; Mr. Bishop, secretary.

The theory of wireless telegraphy and telephony is the present subject in the club, but code practise will probably be the next. Classes will be organized for buzzer practise which will be conducted after school.

A good sending and receiving set has been supplied to the club by the Board of Education. It consists of the following pieces:

Two Navy-Type loose couplers, a crystal detector (a vacuum tube will soon take its place), two fixt and two variable condensers, and two pairs of phones. This forms the receiving set. The sending set consists of a Thordarson three-inch spark coil, a variable oil condenser and a Key West type glass plate condenser, an oscillation transformer, a standard wireless key, and eleven Edison batteries.

The radio equipment is located in the Physics Laboratory, but we hope to get a regular club room soon. Radio Amateurs interested should communicate with Mr. Bishop, Secretary, South Hills High School Radio Club, Pittsburgh, Pa.

Louisville Radio Club.

The Louisville (Ky.) Radio Club was organized February 14th. At present we have 35 members. The meetings are held the second and fourth Saturday of the month, at 8 P. M., at the H. C. Tafel Electric Company's offices until we can obtain permanent quarters.

The officers are: R. D. Bottomley, president; Alfred Matthis, vice president; T. P. Bohan, secretary-treasurer, and A. E. Allmond, chief radio inspector.

We would be glad to hear from all amateurs.

We will soon have a complete station erected for the use of members. Interested enthusiasts should write to Louisville Radio Club, Thomas P. Bohan, secretary-treasurer.

New Haven Radio Association.

The New Haven Radio Association, founded

(*Continued on page* **594**)

The RADIO LEAGUE of AMERICA

HONORARY MEMBERS
ADMIRAL W. H. G. BULLARD, U.S.N. NIKOLA TESLA
PROF. REGINALD FESSENDEN DR. LEE DE FOREST

Manager, H. Gernsback

Boosting Radio

Radio Waves

Articles of Special Interest to Amateur Radio Operators—Questions Received From Them Will Be Answered by the Y. M. C. A. School of Radio Telegraphy.

Answers to Queries.

P. Everett asks how he should connect his spark coil.

Answer: (a) This coil with three terminals has one end of the secondary and one end of the primary connected to the common binding post (2). A diagram of connections is shown.

(b) You do not specify whether in figure 1 you mean the primary or secondary condenser in your second query. If you mean the primary condenser, you should connect it across the contacts of the vibrator, if the makers of the coil have not already done so. The secondary condenser, should be quite small with a spark coil, and hould connect across the terminals of the secondary winding. (See figure 1.)

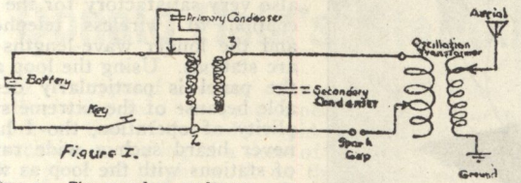


Figure I.

Better Buzzer Tester.

George Quinn, of Edmonds, has contributed an article on a buzzer tester which would serve fairly well, but he has gone to unnecessary trouble of constructing another aerial alongside of the lead in to excite the aerial which affords a means of testing the crystal. Figure II. illustrates a way which is used quite extensively in commercial practice, and which furnishes better results with less work.

This is an up-to-date and easily constructed buzzer tester. There are many other methods of testing the detector, but this is one of the best. When this method is employed there is no danger of burning out the crystal. A-B is a simple coupling, A being made up of one or two turns of the ground wire, and B about ten turns of bell wire. There is an intermittent field set up around B which cuts A, thus exciting the aerial. This may be controlled by a push button in series with the buzzer in the primary circuit B. If signals are too loud the coupling between A-B may be reduced until the proper strength is obtained.

In last Sunday's issue the omission of a line resulted in a serious mistatement. The data on the primary input and the secondary output should have been twenty-five watts and 5,000 volts, respectively.

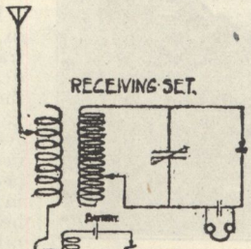


Figure II.

MANY requests have been received by us for an article on the construction of a simple radio telephone. W. D. Alter of Tuxedo, N. Y., contributes in this issue an article describing such a radiophone, designed and built by him, for which he claims excellent results. In a later issue he promises to contribute a second installment of this article in which he will describe the construction of the A. C. to D. C. transformer-rectifier unit for furnishing the high voltage direct current to the plate circuit of the radiophone. Directions for making the rectifier tube itself will be included. The following is a description of Mr. Alter's radiophone set:

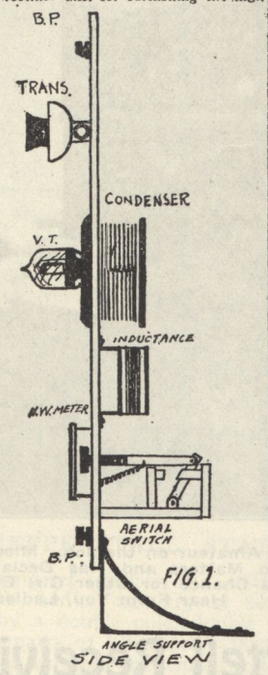


FIG. 1.

A Simple 200-Meter Radiophone.

The radiophone herein described is of very simple design, but this is found to be the best for amateur work. Figure 1 is a side view, figure 2 a front view of the panel and figure 3 gives the hook-up used. No dimensions are given, these being left to the judgment of the builder, who may wish to make the panel fit certain conditions in his particular station.

The bulb for transmitting may be either a small, coated-filament, power tube, a Marconi VT or an Audiotron. The first-named bulb should prove the most efficient, and a range of probably 25 miles might be obtained. Using a Marconi VT, the distance possible to transmit would be about 15 miles, when a voltage of 500 V. direct current is impressed on the plate. Although the Audiotron tube is not as rigidly constructed or as staple in operation for transmitting in this set as either of the other two tubes mentioned, yet very satisfactory results have been obtained with it.

The details of the apparatus comprising the oscillating circuit are clearly shown in the drawings. The transmitter, which may be any ordinary line telephone transmitter, is placed at the top of the panel; the filament rehostat and variable condenser at the left and right respectively below the transmitter; the VT is inserted in a socket at the center of the panel; the hot wire ammeter and aerial switch are located at the left and right respectively beneath the rheostat and condenser. The aerial cwitch is of the single-pole, double-throw variety and is operated through the panel by means of a composition knob and fibre rod, to which a spring is attached so that it is always in the receiving position except when the knob is pushed. The variable condenser should have a capacity of .0007 MF. It is best to calibrate the condenser scale to be direct-reading as to wave-length. This will enable the receiving station to avoid considerable interference. The inductance is made of a wooden disc 3½" in diameter by 1½" thick, wound with 2½ turns of No. 22 D.C.C. wire, which will cover a space of about ⅞". The maximum wave-length of this coil, used in connection with the condenser specified, will be about 245 meters with an average amateur antenna. It is important that the coil be tapped at the thirteenth turn and connected to the filament. The grid leak has a resistance of 2 megohms. The simplest method of securing satisfactory modulation is by connecting the telephone transmitter in series with the ground lead. Angle brackets may be used to support the panel.

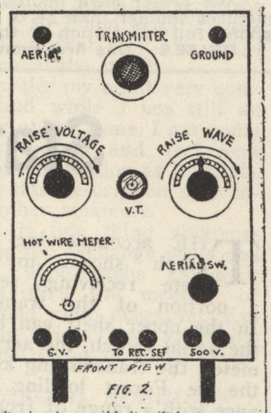
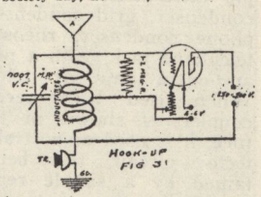


FIG. 2.

New Home Is Found.

The Radio Engineering Society announces that, due to the building in which its club rooms are now located having been sold, it will be necessary for the society to vacate these rooms by May 1. However, new quarters, more centrally located in the down-town business district than those now occupied by the society, have been found, and while arrangements have not been finally completed, it is believed that the society will move to its new home on or before May 1. Until then meetings will continue to be held at the present club rooms as usual. Announcement of the location of its new home will be made by the society as soon as negotiations for occupancy have been completed. Officers of the society say, however, that the building under consideration is ideal for the installation of a radio station. In this connection they advise that further donations of radio appartus for this station have been received, including a Benwood rotary gap, presented by two members of the society, Messrs. Devaney and Olsen, who conduct the Radio Electric Company in the East End.



Two Interesting Samples of Radio Departments Which Run Every Sunday in Metropolitan Newspapers. Due to Lack of Space, the Originals Are Greatly Reduced.

WE spoke editorially last month of how two progressive radio organizations in this country are using their newspapers to further the art in general. Since then we have received a good many letters on the subject from secretaries of Radio clubs and we take occasion on this page today to reproduce the interesting Radio Departments of the two organizations.

The *"Radio Amateur"* is publisht every Sunday by the Pittsburgh *Gazette Times*, while *"Radio Waves"* is issued Sundays by the Seattle (Wash.) *Post-Intelligencer*.

These two papers are not small papers by any means, but each has a large and extended circulation. It speaks well not only for the two gentlemen who run these departments, but also for the enterprise of the publishers of these two great papers who recognize the great and growing body of radio amateurs in this country. We are informed that hundreds upon hundreds of amateurs read these articles every Sunday with great interest, and these Radio Departments have become well establisht with these two great newspapers.

The secretaries of the various clubs should take cognizance of this and should try and start a similar department in their local newspapers.

If the Editor of your local paper remains skeptical, it would be well to show him the page, or better still, send for the two papers, and show them to him. It will convince the Editor of the importance of Radio.

MONTHLY PRIZES

A First Prize of $10.00
A Second " " 5.00
A Third " " 3.00

will be paid hereafter every month for the best three letters submitted to the R. L. O. A. by any of its members. These letters will be publisht on this page.

The subject of the letters is

"WHAT THE R. L. O. A. HAS DONE FOR ME"

Directly due to the League thousands of amateur members enlisted in either Army or Navy. Every member must have some good story to tell us. We want that story for the benefit of other members. If you did not enlist, but wish to write on another topic AS LONG AS IT HAS A CONNECTION WITH THE R. L. O. A. YOU MAY DO SO. Such a letter may win the 1st prize as well.

PRIZE CONTEST
RADIO LEAGUE OF AMERICA
231 Fulton St. New York City

Club Directory.

Due to the fact that we wish to catch up on our schedule, this issue was closed almost before the March number was in circulation, and for this reason the Club Directory will not appear until the next month, as we had not sufficient time to get replies from all the clubs. In case any of the clubs have not received our special letter, we would appreciate if they would fill out the blank printed on page 496 of the March issue.

THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

PRIZES: One first monthly prize of $5.00. All other pictures publisht will be paid for at the rate of $2.00.

Station Of Miss Marianne Brown

FIRST PRIZE

THE accompanying photograph shows my complete receiving set and a portion of the transmitter. In the upper shelf can be seen the aerial switch, the aerial ammeter, the transmitting key, and the De Forest loading inductance with a range of from 2,500 to 12,000 meters. Below there is a Murdock loose coupler. Behind the coupler, somewhat hidden, is a Grebe 20-volt storage battery used for the plate circuit. Next to this comes what I call my "ultra-audion panel." This was designed and constructed by myself for use with a loop. It contains a simple ultra-audion circuit—tuning condenser, grid condenser, telephone condenser, rheostat and telephone jack, with a place for an extra pair of telephones. When used with aerial and coupler as shown in the picture, it is used as a straight detector circuit, this being obtained by a simple rearrangement of connections, the regenerative element being supplied by the variometer tickler coil shown to the right. Of course, with the loop the oscillating circuit is used, permitting the reception of undampt signals.

Here is the Lady Amateur on the Job. Miss Brown Is a Real Enthusiast in Radio Matters and Has Declared It to Be a Great Game. Here is a Chance for Other Girl Experimenters. Let Us Hear From You, Ladies.

I have had very satisfactory results with my four-foot loop, wound with forty turns of No. 18 wire. Taps at seven and thirty-three turns permit a variation of from 300 to 2,800 meters. This, you see, takes in nearly all the commercial stations. It is also very satisfactory for the reception of wireless telephone and the longer wave-lengths of arc stations. Using the loop and the panel is particularly desirable because of the extreme simplicity of operation, tho I have never heard such a wide range of stations with the loop as with the outdoor antenna.

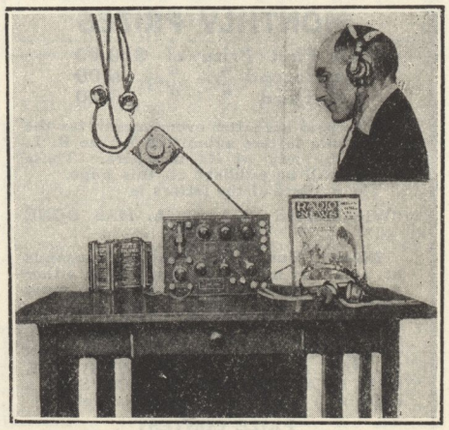
In the lower shelf, as shown in the picture is a ½ K.W. Acme transformer and an oil condenser. In connection with these I use a Murdock rotary gap and a Murdock transformer. As yet my transmitter has been used only experimentally. I expect to have it in working order in a short time, and can tell you better about communication with other amateurs and distance work later on.

MISS MARIANNE C. BROWN,
206 W. 86th St., N. Y. City.

I. H. Kattell Receiving Station

THIS is a photograph of my set, the "RW 4" as well as myself. I was actually listening to MUU, Carnavan, Wales, at the time flash was taken. For antenna I was using one copper wire No. 9, 240 feet in length, with an average height of 20 feet. I can also receive this and other foreign stations on a wire 100 feet long and have copied Glace Bay on the ground wire alone. My lead-in is 25 feet long and my ground is the same length, which consists of a No. 15 copper insulated wire soldered to a water pipe. I am also send- describes the set better than I can. I have ing you one of the Mignon catalogs which done my best to get you a good picture. and consider the RW 4 the best undampt set I ever sat down to. I will give you a few of the calls of stations I have actually heard working, and can hear them almost every night. These are as follows: NFF, NSS, NDD, BZL, BZM, BZQ, NAO, BZR, FL.GB, IDO, LCM, MUU, NAU, NAW, NAY, NBA, NPL, NPG, NPM, NPN, OUI, POZ, YN, XDA, VAL,****

I experience absolutely no interference from dampt stations and there are several high power amateur stations in this city. It is truly an undampt set. I am intercepting new stations with the RW 4 right along, which I hear working. A few nights ago I also heard POZ using the automatic sending machine. It was very speedy, but could read a few words now and then. The set is equipt with an audiotron detector as well as Wireless Specialty 1,000 ohm receivers, and for a simple detector set believe it is a wonder. Have exchanged notes with amateurs having as high as six steps of amplification and they agree with me.



Although Mr. Cattell is Old Enough to Have a Few Little Amateurs Himself, He Takes a Keen Delight in Copying Long Distance Stations on His Compact Little Receiver.

I have not found time to experiment with transmission as yet, and if I do it will mean that I will have to possibly change the insulation of my antenna in order that it stand the increased potential of a transmitting set. In the future I may do so. By that time, however, spark transmission may be out of date, and instead of the old rotary gap or quench gap I will have bulb transmission.

Let us look forward to that day at any rate. It will surely be welcomed.

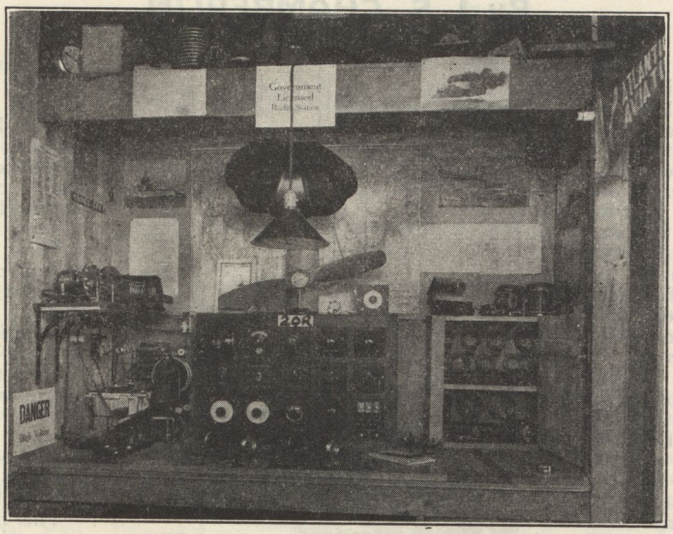
I. H. KATTELL,
c/o Lackawanna Depot,
Binghamton, N. Y.

Harold Robinson's Station

HERE is a good photograph of my station; license No. 434, call 2 Q R, at my home, No. 13 Walnut Street, Keyport, New Jersey. Since this photograph was taken I have installed a De Forest radio telephone set on the right-hand side of the table and am sorry that it could not be included in this photograph.

You will note from the photograph that I have a one KW. Thordarson transformer in my transmitting set, sending thru Dubilier condensers, International Radio Company Oscillation transformer, and other instruments necessary to complete the set. As this part of the set is new, I have not made any records, but have been heard 500 miles out to sea and have worked Utica, N. Y., with it.

The receiving set is composed of De Forest unit panels, and I built the set up myself, changing the design slightly to include a two-stage amplifier, detecting either on audion or on crystal. I am adding two more stages of amplification, making four in all.



We Think This Is a Mighty Good Arrangement and an Efficient Manner of Building a Station. Note the DeForest Panel System as Well as the Little Cabinet Containing All Sizes of Honeycomb Inductances.

You will note the De Forest loud-speaking horn up over the set which brings the signals in all over the room, even on the detector, and with the two-stage amplifier signals come in so loud they can be heard all over the block. P O Z and M U U come in so loud that they are heard clear out in the street.

I consider my outfit very complete, and while I am still an amateur at the game, I am going into it thoroly and feel very proud of my station as it stands. I hope this description may interest other amateurs.

That is one thing amateurs ought to do, exchange ideas and publish photographs of their stations thru the medium of some good radio magazine. Exchanging ideas and thoughts that's the thing in radio of today.

HAROLD ROBINSON.

Donald Haig's Station

This is a type of amateur station that is rapidly fading into the past, especially at the present time of the audion epidemic and transmitters consisting of a sheet of bakelite with a piece of bright work on the front.

A Good Old Fashioned Station With Everything Within Reach. Mr. Haig Belongs to the Old School.

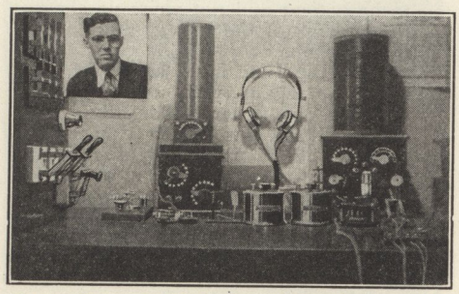
To many of the present-day amateurs this station may appear as curious as a horse car would on Broadway, New York. It was built in the days when folks thought the wireless waves would not radiate properly if the gap was not enclosed in the helix, and the more noise the spark made the farther it would carry. The apparatus in use is obvious from the photograph and consists of transformer, Leyden jar case with the secondary of the jigger mounted on top and within the secondary is the primary of the oscillation transformer containing an octagon spark-gap muffler which encloses the straight gap. The gap muffler has a round peep hole for inspection of the spark and the gap has cooling flanges on both electrodes. An anchor gap is inserted in circuit between the secondary and the lighting switch and series jars can be cut into the ground-lead. The hot-wire ammeter is connected to the ground bus-bar, which is of liberal cross section. A rotary gap is used as an alternative and is started from the starting box, which is mounted on the side of the typewriter shelf. This starter is interconnected with the drop switch (antenna switch) which automatically trips the change-over no-voltage coil on the starter when thrown up to the receiving position.

J. DONALD HAIG,
118 East Maple Avenue,
Merchantville, N. J.

W. L. HEPPENSTALL STATION.

My receiving set consists of a 2400-meter loose coupler, audion and crystal detector, controlled by a double pole, double throw switch, two pairs of "Brandes" 2000 ohms phones, three variable condensers, one fixt, two loading coils with a ten-point switch control, six-volt forty A.H. storage battery for audion, detector test, with a small key on the table to control it. All, including the switchboard on the left, were manufactured by myself, except the variable condensers, which are Murdocks. The set is wired for dampt and undampt wave reception and receiving from 150-7000 meters. I obtain official time at 12 A. M. and 10 P. M., weather and press news from NPY.

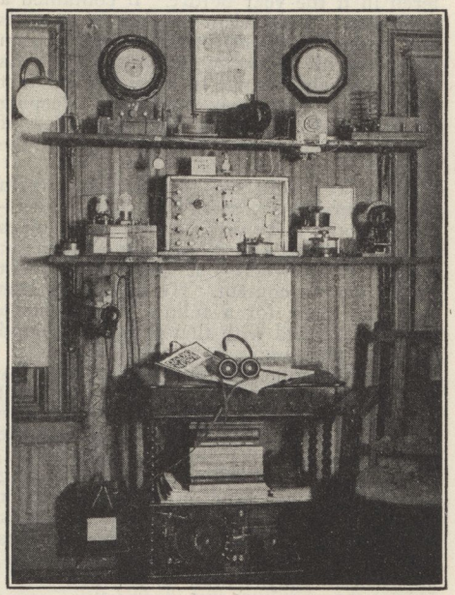
W. L. HEPPENSTALL,
2047 W. 29th St., Los Angeles, Cal.



Very Good Results are Secured by This Amateur Both in Receiving and Transmitting.

O. Schumann Station

Here is a photograph of my set. I never was more satisfied and its accomplishments are marvelous compared to our pre-war results. Without taking the phones from the table I copy any station within reason-



With This Amateur Set, Mr. Schumann, Has Secured the Necessary Instruction to Become a Full Fledged Commercial Operator.

able distance. My aerial is only 60 feet long and 40 feet high, but European stations come in fairly loud and are copied with ease. Strange to say, the location is most unfavorable.

I don't bother with sending and my object is to have everything practical and reliable. Thanks to "Marko" storage batteries the set is very stable and I can listen to a station for hours without one signal fading. For short waves from 100 to 1,000 meters I use a Blitzen tuner, for waves from 1,000 to 20,000 meters I have honeycomb coils wtih an audiotron detector and a two-step amplifier. They work well on one storage battery, 6 V-80 A.H., but for

(*Continued on page* 588)

Radio In Camp

By J. S. CHAMBERLIN

FELLOWS, did you ever have a desire to get out in the mountains with nothing to do but listen in on a little old receiving set? Out where your father could not ask you to go on an errand, just as you were about to make a new record in long distance reception? Out where your sister could not misplace about half your instruments and put all the rest out of commission with her endless dusting and housecleaning? Ever have that desire? So have I and what's more, I was fortunate enough to have that desire fulfilled. QSY to about 2500 meters and I will send awhile.

While deer hunting in the mountains of Northern California several years ago my partner and I wandered into an abandoned logging camp. As we had been eating, sleeping and tramping in the rain for three days you can easily imagine how we welcomed the sight of shelter.

The camp, which consisted of one row of cabins, was situated in a deep canyon-like valley, walled in on either side with hills that were all but perpendicular. Immediately in front of the cabins was a small winding stream over which a trestle had been constructed the entire length of the valley; and on this trestle a few rails were still in place—reminiscent of the days when train-loads of logs had gone rumbling past the camp. Fastened at regular intervals to timbers projecting from the trestle were two strands of galzanized iron wire which had been the telephone line to civilization.

One of the cabins we found to be in good condition, some trappers having wintered in it the year before. It contained a good stove, a sufficient number of utensils and dishes, and the interior having been papered with *Saturday Evening Posts,* was comparatively clean. In view of the fact that it was extremely unpleasant sleeping on rain-soaked ground, the remainder of our hunt centered in the vicinity of the camp.

Being a "Radio-bug," I was not long in seeing here the possibilities for a receiving station. Here was antenna wire—miles of it; high hills that would serve as masts; a good cabin where one could experiment to his heart's content. Here, in fact, was the ideal place for a fellow to hook up a small outfit, and with that thought in mind I began planning accordingly.

Upon returning to town I took into my confidence another Bug, whom we will call Lloyd Mathews. After giving him descriptive details of the camp, its location and the facilities it held for the proposed station, he became highly enthusiastic; suggesting that we lose no time in making a tuner suitable for the occasion, and getting back to the camp. The thought of numerous evenings spent in unalloyed listening-in, appealed to Lloyd—even as you and I.

We then constructed a small compact tuner of the loose coupled type. By mounting the coils, condensers and detector in a cigar box, only the phones remained to be carried separately, and this made a good outfit for carrying in a knapsack. As an object of beauty the tuner was practically nil; however, the working qualities were not impaired by this fact.

Daybreak the next morning found us on the trail heading for camp; our knapsacks filled with provisions and our thoughts with anticipations of the success we were to have.

We reached our destination at noon and after eating a hasty lunch, started operations by cutting down several hundred feet of the telephone wire. This section of wire, when suspended from hill to hill across the valley, was to be the antenna; then as near the middle of the antenna as we could estimate, we connected a second length of wire which was to serve as the lead-in.

"The Lead-in Apparently Hung From the Clouds!"

Next came the task of raising the antenna, and believe me when I say it was some task. Those hills were a cross between Pike's Peak and Rio de Janeiro's Sugar Loaf, only they had not the notoriety of the two latter points of prominence; and the only way in which they differed from the Alps was the fact that they were bare of snow.

However, with perserverence and a small amount of effervescent language, Lloyd scaled one hill while I climbed the other, each of us dragging an end of the wire. To trees, well up near the summit of each hill, we made our respective ends of the wire fast, first pulling in all the slack possible.

Upon returning to the cabin, we found the lead-in hanging precisely where we wanted it—just outside the window. In lieu of a lead-in insulator, we ran the wire thru a cracked window pane, then to the tuner which was on a box just inside the window.

That lead-in also had a peculiar characteristic that might bear mentioning here. The height of the antenna was so great that it, as well as the lead-in connection, was *invisible* from the ground, consequently the lead-in apparently *hung from the clouds.* To a person not knowing the cause of this astonishing feature, it must have caused considerable thought. In fact, ever since leaving the camp I have momentarily expected to hear of some one finding a direct wire to Mars—the Earth's station being located in Northern California.

The matter of obtaining a good earth connection was easily accomplisht. By running a wire to the stream in front of the cabin, giving it several turns around a steel rail, then rolling the rail into the water, we had a satisfactory ground.

The outfit was then ready for its initial tryout and the first station heard, coming in clear and distinct, was NPH, which in those days was Mare Island. During the night we experienced far better results; NPA and NPB were clear and readable, as were most of the Canadian stations along the coast; VAG, especially, was exceptionally loud. Most of the Naval stations, from North Head to Point Loma, were easily copied; and, on several occasions when the QRM was light, we copied NPM and KHK.

I had with me a heavy billing pencil with which we decorated the *Saturday Evening Post*-covered walls in interesting, if not artistic, way. Using the papered walls as bulletin boards, we copied thereon the daily weather reports of the coastal stations, all the way from Cordova to Point Loma; the daily press reports from NPL and KPH, likewise found prominent positions on the walls.

The aspect of those walls, along with the visible knowledge of that lead-in going straight up to nothingness, must certainly have been the basis of some extremely weird thoughts to any one stopping at the cabin after our departure.

We spent ten days at the cabin during which time, not once were the connections broken by careless dusting; nor were various parts of the apparatus misplaced, as sometimes occurs where Woman is the dominating element of the domicile. Those were ten happy days and our only regret was that they passed all too quickly.

Notice to Readers

In view of the fact that we are still handicapped due to the recent printers' strike, we have as yet not been able to catch up with our schedule. We would therefore ask our readers to be patient and not write us about the lateness of the issue for the next three months.

With the June issue we expect to catch up again with our regular schedule. In other words, the June issue will be out about May 15th. Several other publishers found it necessary to skip an issue in order to come up to date, but we prefer not to do this. We hope our readers will understand and bear with us until we are back to our former schedule again.

THE PUBLISHERS.

DO THE SIGNALS COME FROM MARS OR VENUS?

These here highbrow guys have got the wrong dope about signals coming from Mars. They must be a lot of old bachelors and don't know much about women. They are all wrong. We know where the signals come from. Why, it is a cinch they come from Venus—Gosh! These hifalutin thinkers ought to know quite well that women always have the first word as well as the last. What?—*Gleaned from the D. N. C. Bulletin.*

"DRY STUFF."

Jones: Why is a dry substance like a wireless?

Bones: I give up.

Jones: Because both are "undampt."

Some Observations And Advice—Take It Or Leave It!

By J. DONALD HAIG

IN the following I have taken some odd subjects collected at random. Ones which I have jotted down, off and on, during my experience as a professional operator. It is my intention to bring out some points on operating efficiency by strong contrast with foolish ravings and descriptions, which are, however, not so far fetched after all.

I will give you all the best of the show by quoting the old saying that advice is sometimes that we all can give but few of us take; so paste the following headings in the crown of your hat, and close your lightning switch.

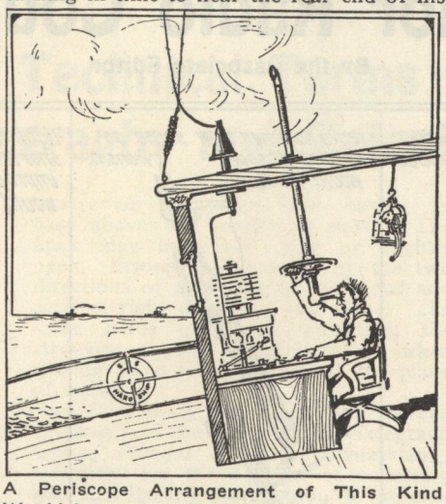
THE "CQ" FIEND.

First of all comes the "CQ" Fiend. You can hear him any time you put on the phones; hammering out his dismal wail from early morn till you go off watch and if you don't go off watch you can hear him some more or your relief hears him. He never runs down—always has a large supply on hand. Especially the kind with the long and elegant attention signal in the lead. The "CQ" nicely drawn out. A "QRU" sent pleadingly enough to bring tears to the eyes of the James Brothers. Then signs off with his own call letters several dozen times for fear the receiving operator won't catch it.

This is pleasant in some lonely parts of the ocean as it gives the effect of having a crowd around particularly if you have a few good CQ'ers in range. It gives one a check on the receiving qualities of the tuner, and you know your antenna is still up and has not carried away. It also drills in the art of selective tuning and weeding out, but don't try to tune 'em because it can't be done. A first class "CQ" man always uses a broad wave of the type which prevailed back in 1898 A. D. You cannot evade him, brother operator.

THE "QRA" BUG.

The next on the program is the "QRA" Bug who belongs to the same species as the "CQ" Fiend. He doesn't miss anyone. No sooner does he spy a smudge of smoke on the horizon, when you are copying a faint signal with the phones clampt tight to your bean and fearing to breath less you drown out the distant press signals from Poldhu. When, bing! off he goes, "QRA stem-winder off port quarter?" Wow! You blow up and think things you could be arrested for. After making a gross or so of QRA's, and the same number of his own call letters, he tacks on several K's, one K not being emphatic enough to suit the case. At night it's "QRA red light off our starboard bow?" In the daytime it's "QRA what tin can off our port beam?" If you are a small tramp with seas washing over your decks it's "QRA Submarine westward bound, ans please?" Oh yes, it's amusing, particularly so if you have just gotten a sensitive point on your pet galena, and someone hands you a QRA right off the stove, on high power. Just like hollering at a foreigner to make him understand the language better. A periscope attachment would be a great boon to the "QRA" Bug, whereby he could scan the horizon from the operating room and not have to spend so much time and labor hot footing it back and forth between the deck and the wireless coop. Now my friends, there are times when a QRA is a valuable asset in the wireless game. If you *must* send one, *make it short and sweet*—one QRA and your own call letter made once is just as good to an old Shell Back operator, as a dozen of each. Generally after the first attention signal is sounded you have time to go out and get measured for a shave returning in time to hear the rear end of his

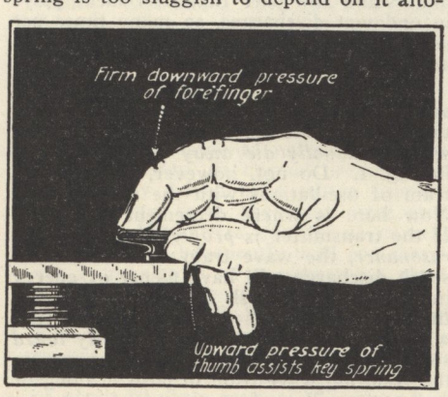


A Periscope Arrangement of This Kind Would Insure the "QRA" Bug Against Passing One Up.

office calls, as well as a few "ans" some "PLS" — "K'S" — "GA'S" — "GM," etc., thrown in for good measure. You answer immediately. You, of course, have your motor-generator started; in fact you had time enough to start all the motor-generators in the North Atlantic and then some. Now the real work begins. He hands you everything on the International Abbreviation chart from PRB to QTF and some others that the London Convention neglected to provide for.

KEY TROUBLES.

Right in here somewhere I wish to ask: Did you ever hear anything over the Radio like a chicken eating corn off a tin roof, and then followed by an apology to the public at large that there was key trouble? It is usually explained thusly: "QRX Key sticking." Undoubtedly! I don't blame it for sticking. There are a lot of misused keys that lack sufficient encouragement and co-operation and therefore go out on strike. They have to send so many CQ's and QRA's, that they are all run down at the heels. Now to be serious. The main cause of a key arcing is that the break is not made quickly enough and allows the flame to follow the contacts. This is caused mainly by not using the thumb to assist the key spring in its upward movement. The spring is too sluggish to depend on it altogether. There are a lot of operators who send with thumb and forefingers on top of the key knob. It is impossible to control the key properly and send good stuff that way and the key will arc, become hot and consequently stick. The function of the key spring is to keep the contacts apart and to assist in sending. Nearly all fast operators use a light spring adjustment and I know several good ones who can take the spring out altogether and still send fine stuff. I need not mention keeping the key contacts clean, smooth and perfectly level and aligned as another antidote for this disease. In this connection, it is the light sender who drops out lots of dots especially when sending "H" or "S." It shows lack of good firm touch and comes from an unfirm grip which results in poor control. Operators who have worked the land wires rarely have a light touch as it is necessary to send heavy in Morse work especially on a poor wire such as an iron wire, where conductivity is poor or travels through many relays where it is hard to make the dots carry. Land wire telegraphers for this reason hold their dots slightly longer. In contrast to the light sender is the heavy sender who drags along as if he was "In the mud." I contend that the study of the American Morse Code is excellent practise for the wireless telegrapher as it promotes better spacing. It is much easier to decipher the Continental code when poorly sent than the American Morse; much better spacing being required in the latter on account of the spaced and dotted letters. Therefore practising the Morse Code will produce better transmitting and make the young Jack Binns realize the necessity of setting the letters out in even rows instead of planting an E up close to an M and producing a G. The only way to become a good sender is to sit down and dope it out carefully for yourself trying different words and peculiar combinations. It takes care and lots of practise to become a clear sender. After accuracy comes speed. Think it over!



This Shows the Proper Manner of Handling the Sending Key Known as the "Catlin Grip."

THE "SWINGING" BIRD.

The next fanatic I have in mind is the operator who after years of hard application has developed what he terms a "Swing." This is to enable his friends on the high seas and elsewhere to recognize him by his chirp. The same as you hear the robin in the springtime. He has the old time circus calliope lashed to the mast. You can hear him shoot a Paid MSG. to Cape Race to the tune of "The Blue Bells of Scotland" or a position report to "NAH" that makes you do the Shimmy. Of course there is something to the swing business if not carried too far. Some operators can make the cadence of syllables roll off producing a pleasant and easy-to-copy style of sending. The idea, however, is to send your message; don't render the Boys a violin solo.

THE S-T-U-T-T-E-R-I-N-G CUCKOO.

Then, there is the operator who stammers, in fact actually stutters on the key. He comes on with the attention signal, your own call letters sent in different styles, then he has to stop and think before making "de." After that he looks up his own call letters in the call book and finally *decides* to SEND THEM. After that the real chaos begins. He cannot decide which part of the preamble to send first and after some thought QRX -....- etc., to let you know he is still around and

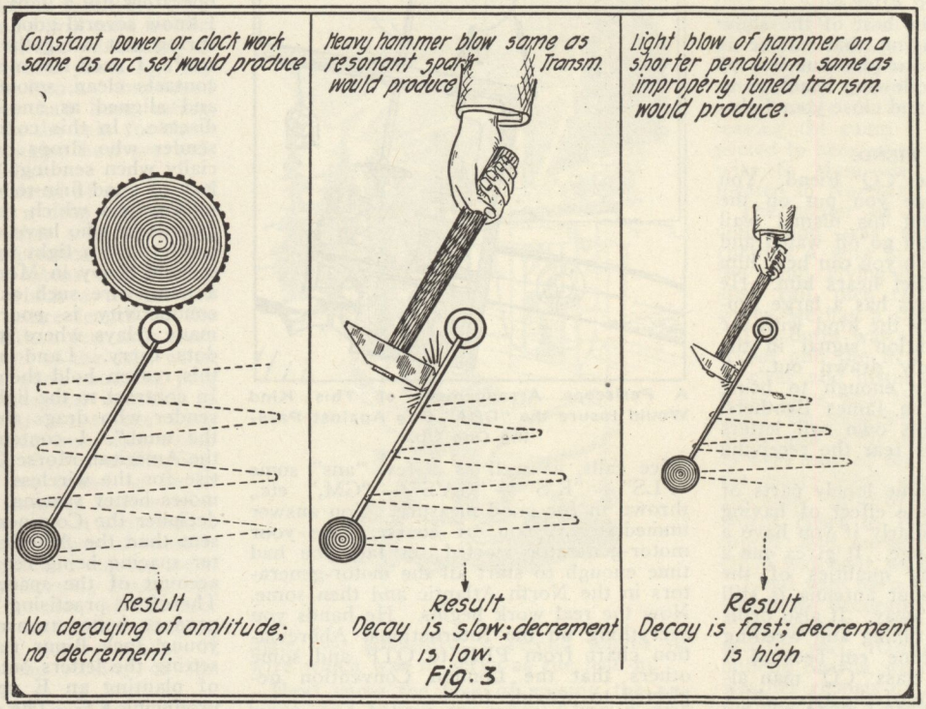
(*Continued on page* 580)

Junior Radio Course

By the Associate Editor

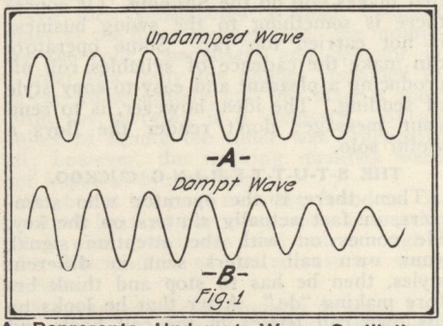
HARDLY a day goes by that the editor does not receive one or more letters from boys from various parts of the country asking the meaning of that awe-inspiring word *decrement*. For the most part they write that altho they have tried to find out what it means from various books, the explanations are too often written in long technical phrases and they are forced to admit that it is too "deep" for them.

Really, boys, there is nothing very difficult about this dreaded word and its meaning. Don't slide over this part until you fully understand it, for you should know just what part it plays in transmitting circuits before you yourself attempt to put up a sending set. Not only that, but if you do not tune your transmitter for the *least possible decrement*, representatives of Uncle Sam will hear your "broad wave" and will soon be on your trail.


Constant power or clock work same as arc set would produce
Result
No decaying of amlitude; no decrement.
Heavy hammer blow same as resonant spark Transm. would produce
Result
Decay is slow; decrement is low.
Light blow of hammer on a shorter pendulum same as improperly tuned transm. would produce.
Result
Decay is fast; decrement is high
Fig. 3

These Three Diagrams Illustrate, in a Graphic Manner, Using the Analogy of Simple Mechanics, Just Why Undampt Oscillations Have no Decrement; Slightly Dampt Oscillations Have Slight Decrement; and Highly Dampt Oscillations Have Large Decrement.

When you think of the word *decrement*, try to associate it with the word DECAY; in other words, the crumbling away or the shriveling of something. That is just what decrement means. A dampt wave transmitter (that is to say the spark system of radio telegraphy which to your mind means plain spark gap, rotary gap, spark coil, condenser and helix), produces many trains of radio waves which leave the antennae and begin traveling in different directions



A Represents Undampt Wave Oscillations While B Represents Dampt Oscillations. Note the Decaying Amplitude of B

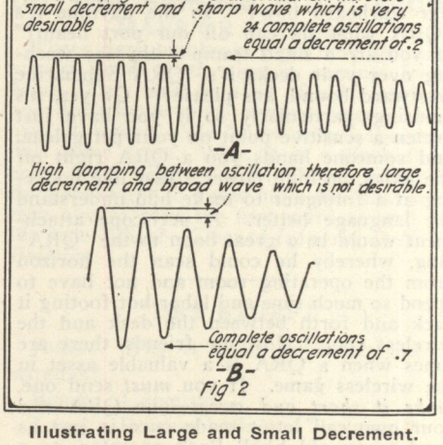
on their way to receiving stations but which do not remain constant in their amplitudes. See Fig. 1 for a better explanation of this. A represents a train of undampt waves which have a *constant amplitude* and therefore *have no decrement*. B, on the other hand, represents a train of dampt waves which *have not a constant amptitude* and therefore are said to *have a decrement*, that is to say, the wave gradually decays or shrivels down to zero, and that is the end of it until another condenser discharge takes place and a new set of oscillations is started.

This is really going over old ground for the difference between dampt and undampt waves was explained to you in the January issue. However, it is brought back to your mind again so that you will better understand the part that decrement plays in undampt discharges, so many times per second, according to the way the circuit is arranged.

Every time this condenser discharges, a spark occurs at the spark gap and this in turn creates *a train of dampt oscillations* which *gradually die away* as shown in B in Fig. 1. Do not, however, confuse this train of oscillations with the wave length. Now here is where decrement comes in. If the transmitter is *properly tuned and in resonance*, the wave train caused by each spark discharge will have plenty of energy in back of it to push it along and it will therefore not die as quickly as is the case when the transmitter is *not properly tuned* so that there will not be much energy in the resulting wave train to push it along or make it oscillate for any great distance. This may better be illustrated to you by Fig. 2. In A, we have an ideal wave train caused by one condenser discharge of a properly tuned transmitter. In this case the oscillations, having plenty of energy in back of them, go along a much longer stretch than in Fig. B, where they decay or die down *very quickly*.

When you see the expression *logarithmic decrement of oscillations*, it simply means that radio scientists discovered a long time ago that the length of decay between one oscillation and the preceding one has a constant ratio for all spark discharges, no matter whether they be feebly dampt or highly dampt; in other words, whether they decay quickly or slowly. For that reason the following standard expression has been adopted—"The Naperian Logarithm of the ratio of one oscillation to that of the preceding one is called the logarithmic decrement."

The United States regulations *which govern the amateur* and commercal stations have decided that a transmitter tuned in such a way that it has twenty-four (24) or more complete oscillations *for each single spark discharge* is the ideal one to have. Such a spark is said to give a pure wave and one which *will not interfere* with receiving stations tuned to another wavelength.


Small damping between each oscillation therefore small decrement and sharp wave which is very desirable
24 complete oscillations equal a decrement of .2
-A-
High damping between oscillation therefore large decrement and broad wave which is not desirable.
Complete oscillations equal a decrement of .7
-B-
Fig 2

Illustrating Large and Small Decrement.

A at Fig. 2 illustrates such a wave, and in speaking of its character it is said to have a decrement of .2 for a complete oscillation; that is, from start to finish. B of Fig. 2 shows a *very undesirable wave train* produced by an *improperly tuned* transmitter, *i.e.,* one having about six oscillations from start to finish. In this case the decay between each succeeding oscillation is very rapid and therefore the train quickly dies away. For that reason it is said to have *excessive damping,* or a decrement of about .7, which the United States government *will not permit,* and therefore it is one which the amateur must avoid if he desires to keep out of trouble.

From what has been said it will be easily seen that the undampt wave is A of Fig. 1 does not have any decrement at all since the amplitude of the wave train remains constant and *does not decay* as in the case of the dampt waves. As you have previously been told, the undampt waves may be produced by an arc, high frequency alternator or by a vacuum tube. The dampt waves, on the other hand, which have a decaying amplitude, are produced by the ordinary spark transmitter and the one you will probably use.

Fig. 3 is a simple water analogy of three types of waves; that is, *undampt, feebly dampt,* and *highly dampt.* In the case of the undampt wave at A the swinging pendulum is supplied with a constant source of back-and-forth motion by means of a clock spring and therefore its oscillations are *constant* and do not decrease or decay in their to-and-from motion. In the case of the feebly dampt waves the pendulum *is not* supplied with a constant back-and-forth motion as in the case of the arc, but instead has been given a violent blow to one side and it has been set swinging back and forth rapidly, but since the source

(*Continued on page* 595)

Dictionary of Technical Terms Used in Radio Telegraphy and Telephony*

Back E.M.F., Counter E.M.F., Opposing E.M.F.—Due to opposite and opposing current produced by self-induction set up in a circuit by a changing supply current. In a cell it is due to Polarization.

Balancer—A small auxiliary dynamo used in Three-Wire System to balance pressure in the three leads.

Balancing Capacity—An artificial "Earth." Capacity inserted in aerial circuit to take the place of a natural ground. May be greater than but never less than the capacity of the aerial.

Ballistic Galvanometer—One used for measuring currents of short duration, such as a condenser discharge. It is so arranged that the first swing is proportional to the quantity of electricity passing thru it during a momentary discharge. It is usually of the Reflecting or Mirror type.

Banks—Referring to condensers is a complete unit of a compound condenser contained in one case.

Bank Winding—An improved and modern form of winding inductance, one layer on top of another in such a manner that distributed capacity is reduced to a minimum; a considerable saving of space being also accomplisht.

Bar Magnet—A Magnetized straight bar of steel.

Barretter—A thermal detector. Electrolytic Detector has a small loop of Wollaston wire enclosed in a glass bulb. Tip of loop is dipt in Nitric Acid which, dissolving the silver, leaves a short length of extremely fine platinum wire. Bulb is exhausted of air. Telephones with one single shunted cell are connected across ends of loop so that a weak current is constantly flowing thru it. When oscillations pass thru loop, heat and resistance of platinum wire are increased, thus suddenly decreasing passing current, which action produces audible sounds in the telephones. May be used as a Bolometer.

Base—See Logarithm or Log Table.

Battery—A collection of voltaic cells or storage cells or of Leyden jars joined up in series. In fact, any collection of units multiplied and used together is called a battery.

Beat Reception—The method of detecting received oscillations, usually undampt, by causing them to interact with other locally produced sustained oscillations of slightly different frequency and generally of greater amplitude. The beat or resultant note is the difference between the frequencies of the two independent oscillations. The method is one of extreme sensitiveness and selectivity. May also be employed, tho not so effectively, for the reception of dampt wave trains, in which case a hissing sound only is produced in the telephones by incoming signals. Also known as Interference and Heterodyne reception.

Beat Waves—See Coupling Waves.

Bellini Tosi Aerial—A directive aerial of square or triangular form having its base above but parallel to earth. The apex may be either close or slightly open. Strongest radiation in the two directions of the plane of the aerial and zero at right angles to this plane. The same holds good for reception, the strongest signals being received when coming from the direction of the plane of aerial.

Berne Bureau—A branch of the Bureau (Agency) of the International Telegraph Union, situated at Berne, Switzerland; establisht for the purpose of collecting and distributing information in accordance with the requirements of the International Radio Convention.

Bi.—See Bismuth.

Bichromate Cell—A Single-Fluid Cell. Consists of two carbon plates immersed in a solution of bichromate of potash and sulphuric acid with water between which is a removable zinc plate. E.M.F. 2 volts. Has low resistance.

Bight—A loop formed in a rope at any place except the ends.

Billi Condenser—Consists of a metallic tube made to slide over an insulating tube having a metallic lining. A variable tubular condenser.

Binding Post—Screw and nut arrangement designed and used on electrical and radio apparatus to make proper connection to and from an external source.

Bipolar—Having two poles. Usually refers to a dynamo or motor whose armature rotates between a field magnet having only two poles. Most modern machines are Multipolar.

Bismuth—Bi. Brittle white crystalline metallic element. Atomic weight, 206.9; specific gravity, 9.82; melting point, 496° Fahr.

Black Tellurium—See Nagyagite.

Blower Motor—Refers to motor-driven fan used to deliver a high pressure blast at the spark gap to prevent arcing.

Blowout—See Magnetic Blowout.

Board or Trade Unit—B.O.T. 1,000 Watt-Hours. One and a third Horse Power.

Bolometer—Type of Wheatstone Bridge having an easily heated resistance, such as a very fine wire in one arm. A Barretter may be used.

Booster—An American expression signifying a small dynamo used in conjunction with main dynamo to temporarily raise, when necessary, its normal pressure. It is generally driven by a motor supplied with energy from the main generator, and thus becomes a continuous current transformer. Frequently used for charging accumulators of a generating plant. See Reversible Booster.

Bornite—($3Cu_2S$, Fe_2S_3). Also called Erubescite and Peacock-ore. It is a crystal rectifier. Used in combination with Zincite. Is a copper ore composed of about 60 parts copper, 14 iron and 26 matrix crystals. Owing to peculiar bronze tint when newly broken is known as "horseflesh" ore. It quickly tarnishes, however.

Boron—B. Non-metallic element. Dark Brown powder. Atomic weight, 10.9.

B.O.T.—Board of Trade Unit. 1,000 Watt-Hours. Nearly one and a third Horse Power. Is the product of power in Watts and time in hours divided by 1,000.

Bradfield Insulator—A particular form of Leading-in Insulator, consisting of an ebonite tube provided with zinc cone and ebonite spark discs, for breaking up continuous streams of rain running down outside which might cause serious earthing of aerial. The whole is held in position, half way thru roof of operating room, by means of a stuffing box. The aerial is led in by means of a steel rod running thru center of tube.

Brake Horse-Power—Power a machine can exert in doing outside work, i. e., other than driving itself. Power that a "brake" would have to exert to stop a machine. Total power is called Indicated Horse Power (I. H. P.)

Branly Coherer—Early form of Marconi Coherer; see Coherer.

Brass Ordinary—Alloy composed of about seven parts copper and three parts zinc.

Brass Saddles—Small clips used for holding wires in position on walls, etc., fixt by a small brass screw at each end.

Breaker—See Contact Breaker.

Bridle—A short length of rope whose ends are fitted with a Thimble for attaching to lugs at end of spreader. A thimble is also fitted to the middle of the bridle for attaching to the Halyard.

Brimstone—See Sulphur.

C—See Carbon.

Ca—See Calcium.

CaC2—Calcium Carbide.

Calcium—Ca. Atomic weight, 39.8.

Calcium Anhydrous—Quicklime. Placed in discharger or spark gap case to absorb moisture and gases produced by sparks.

Call Bell—A coherer arrangement giving an audible sound used for calling up an operator to be ready to receive signals. It is generally actuated by long dash signals sent by the sending operator.

Calorie—Cal. Unit of heat. Amount of heat required to raise one kilogram of water one degree centigrade.

Capacity—Power of containing. A condenser has unit capacity (Farad) when a charge of one Coulomb creates a difference of potential of one Volt between its terminals. This farad being too large for practical purposes. The Micro-farad is used.

Brush Discharge—A faintly luminous discharge which takes place at the surface of conductors charged to high potential due to Ionization. Is also called Corona.

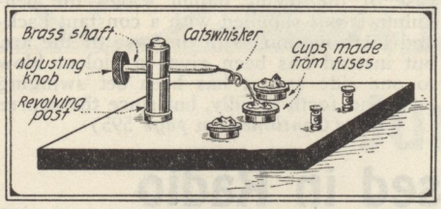
Brushes—Fixt carbon blocks or copper gauze held in a position that makes contact with the commutator of a dynamo or motor for the purpose of collecting current generated from or supplying

(*Continued on page* 589)

*This Dictionary was begun in the March issue on page 494.

Junior Constructor

A TRIPLE-CUP MINERAL DETECTOR.



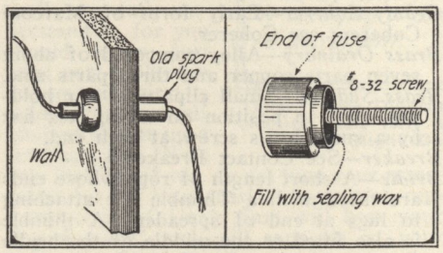
This Is a Simple Three-Cup Mineral Detector, Easily Made at Little Expense.

First a base of hard rubber or fiber is procured. This is arranged as shown in the drawing. Then several 15 ampere fuses are called into use; three caps taken from these will make excellent detector cups. A hole is drilled in each base cap after the fuse wire and asbestos powder has been removed. Through this hole is shoved a 3-inch shaft threaded on one end with a catwhisker soldered to one end. On the threaded end screw a knob. Put a crystal in each cup and test out on receiving set. The standard should be pivoted at the base.

Contributed by T. W. MARTIN, JR.

INSULATOR FROM SPARK PLUG.

Here is a new lead-in insulator. All that is done is to take an old Ford spark plug apart. Bore a half inch hole through the wall you wish to run the lead-in through and insert the porcelain insulator from the



This Discarded Spark Plug Was Used as a Lead-in Insulator.

Dig Out an Old Fuse From the Junk Box and make a Switch Knob of It.

spark plug. If the wall is too thick for one plug another one may be pusht in on each side.

Contributed by FRED WHEELER.

SIMPLE SWITCH KNOB.

A very good and yet simple switch knob can be made from a half-inch section of an old cartridge fuse. Take a battery tap or any 8/32 machine screw and fasten to smooth board with a screw. Place the piece of fiber tubing over the tap, being sure that the tap is in the center, then pour full of melted wax from an old dry cell.

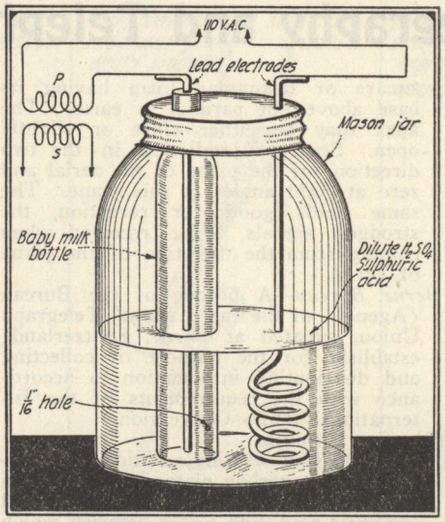
A substitute switch point may be made from a flat head brass wood screw. The screws are put in the panel where they belong, being screwed down even about an eighth of an inch high. The slot is then filled with solder and smoothed off with a file. Connections are soldered to the other side.

Contributed by
EDWIN L. HARTMAN.

INEXPENSIVE ELECTROLYTIC INTERRUPTER.

This is an idea for a cheap and simple electrolytic interrupter.

As is shown in the diagram the only things called for are: a glass jar, one glass bottle and some lead. The jar must be large enough to hold the bottle besides the solution and another electrode. The main secret lies in the small bottle. About half an inch from the bottom a hole is made with a file. The larger the hole the more the "juice"; approximately a 1/16-inch hole



A Mason Jar, a Baby's Milk Bottle, a Strip of Lead and a Diluted Solution of Sulfuric Acid, and Presto! You Have an Electrolytic Interrupter. Be Sure to Bore an Air Vent on Cover of Jar.

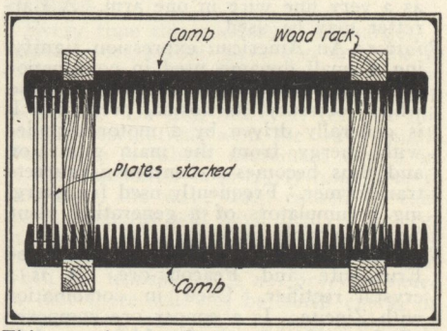
will serve the purpose. A strip of lead to which a wire has been soldered is put into the bottle; this strip should reach to the bottom. Another lead electrode is prepared and this is to be put on the outside of the bottle in the jar. The jar is filled with water so that the hole in the bottle is covered by at least an inch of water. Sulphuric acid is then added till the desired results are obtained. If the hole in the small bottle is too big, the lights will blink.

Contributed by THEODORE SHAW.

A CONDENSER RACK.

Who said hard rubber condenser racks? Materials for a good hard rubber rack are at hand in *four old combs,* with every other tooth broken out. Two combs above and two below, set in a simple wooden frame, with the plates slipped between the teeth, makes a first class rack. It can be immersed in oil or left in the air.

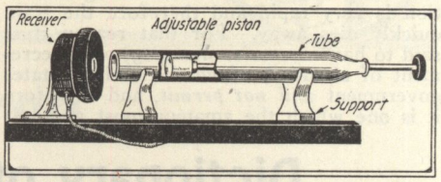
Contributed by D. D. WHITSON.



This condenser Rack Necessitates Four Combs But Don't Take Your Mothers Best Ones. Buy Some Cheap Ones.

SOUND AMPLIFIER.

Here is a scheme whereby radio signals may be amplified to about twice their origi-



By Moving the Adjustable Rod One Way or the Other the Emitted Sound From the Receiver Can Be Varied Accordingly.

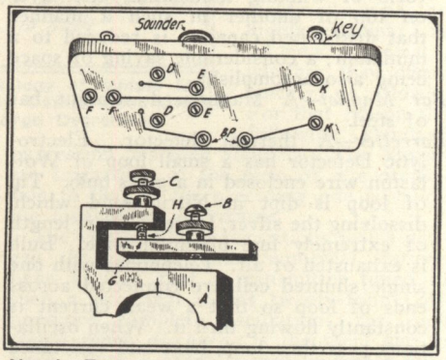
nal intensity. The principle employed is that of the "quarter column" tube resonator. If a vibrating tuning fork, or a telephone receiver through which signals are passing, be held at the open end of a "quarter-column" tube, and the piston adjusted so that the distance from the edge of the tube to the piston-head, plus 4/10 the diameter of the tube is one-quarter of the wave-length of the sound from the fork or telephone, then the "quarter-column" will give resonance to the sound, thus amplifying the signals, in the case of the telephone receiver.

Contributed by JOSEPH LIEBOWITZ.

BUZZER PRACTICE SET FROM TELEGRAPH SOUNDER.

It might be of interest to know that an excellent buzzer practice set can be had by altering the connections of an ordinary telegraph sounder and key. The diagram enclosed clearly shows how this is done.

Any desired tone can be had by adjusting the upper contact screw C and the little armature spring.



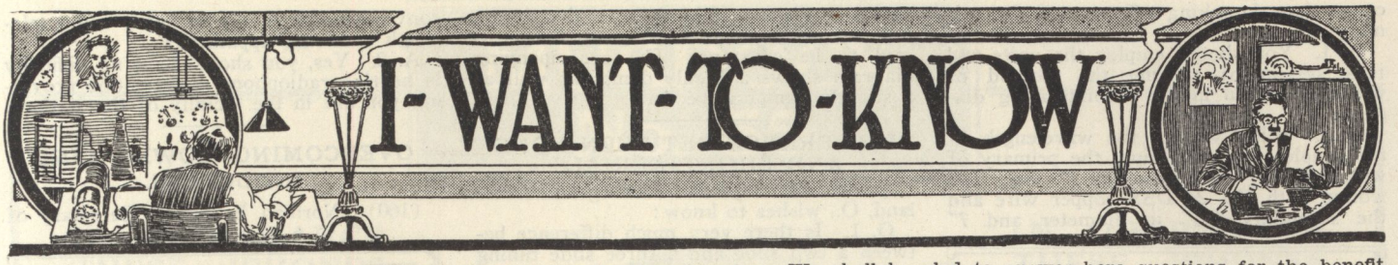
Nearly Every Amateur Has a Sounder Laying Around. Try Using It As a Buzzer in This Manner.

The lower screw B is not used and should be screwed up where it cannot touch A. The screws FF hold the sound post, DD the magnet, EE holds the sounder frame and KK the key. If good contact is wanted at all times, it is suggested that small pieces of silver be soldered at points G and H.

Contributed by
WILFRED J. McCAFFREY.

INCORPORATING THE LOOSE COUPLER IN A PANEL SET.

Amateurs who would like to use their loose coupler in a panel set, but who hesitate to mutilate it in order to do so, may be interested in the following scheme: The top and base of the coupler are removed. A wooden cabinet is made similar to the one used with the "double deck receiver." The lower part is made just large enough to contain the loose coupler, the panel of coupler being flush with back.



THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you make your letter as brief as possible.

DETECTOR AND TWO-STEP AMPLIFIER.

(148) Mr. Kenneth Storch of Beecher, Ill., asks:

Q. 1. Will you please publish a diagram with connections showing jacks and telephone plug for an audion detector and a two-step amplifier?

A. 1. A diagram suitable for the purpose you request is herewith publisht.

Q. 2. How can I cut down 110 volts D. C. to 60 volts?

A. 2. This may be done for all practical purposes by inserting a 110 volt lamp in series with whatever instruments you wish to use. The resistance of the lamp in series will lower the potential of the applied direct current to one half; in other words about 55 volts.

TUNING COIL HOOK-UP.

(149) Mr. Walter Sperr of Brooklyn, New York, wishes the following information:

Q. 1. Please give me a hook-up for two double-slide tuning coils in series.

A. 1. You will find the desired hook-up on this page.

Q. 2. Is it necessary to use a local battery in connection with a galena detector, and will its use increase the strength of the signals?

A. 2. It is not necessary to use a local battery in connection with a galena detector. Altho a local battery can be used, repeated experiments along this line have failed to prove that a local battery is of much benefit for all practical purposes. We, therefore, recommend that you use the crystal alone without any battery.

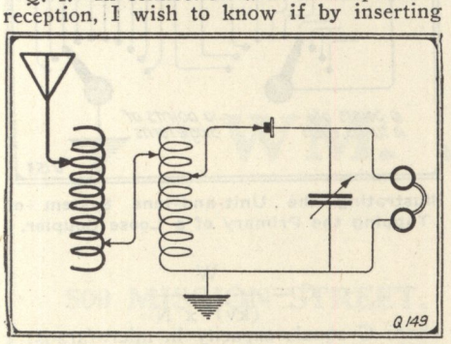
Q. 3. What should the strength of the local battery be?

A. 3. If you wish to experiment with a battery in connection with a galena detector you may use one dry cell preferably an old one properly shunted by a potentiometer.

PRIMARY AND SECONDARY LOADING COILS.

(150) L. C. Hollands of Brookhaven, Miss., asks:

Q. 1. In connection with undampt wave reception, I wish to know if by inserting a 10,000 meter loading coil in the primary circuit, does this necessarily mean that another such coil is needed in the secondary circuit?



In This Case Two Double-Slide Tuning Coils are Used With a Simple Receiving Hook-up.

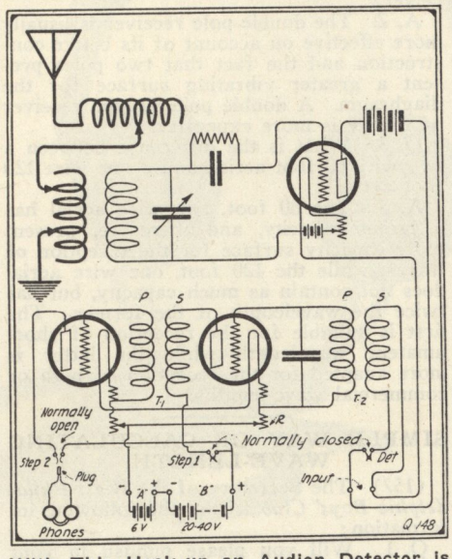
A. 1. Generally speaking the maximum inductance of your secondary circuit should equal the maximum inductance of your primary or aerial circuit. In your case it depends upon how large the secondary of your loose coupler is. You will be able to increase your wavelength by shunting a variable condenser of approximately .005 maximum capacity across the secondary.

Q. 2. In the receiving circuit described on page 112 (Fig. 91) of "How to Conduct a Radio Club" what capacity should C-1 be?

A. 2. The maximum capacity of this variable condenser should be .0005.

Q. 3. Do you think that by using this circuit with an aerial 150 feet long, 60 feet high, a 3,000 meter lose coupler, a 10,000 meter honeycomb coil, I would be able to receive any of the European arc stations?

A. 3. Yes, providing you properly balance your secondary circuit and that you make use of an oscillating vacuum tube circuit such as the Armstrong Regenerative Circuit or any other circuit employing a tickler or feed back coil. A suitable diagram for this purpose is herewith included.



With This Hook-up an Audion Detector is Used as Well as a Two-Stage Amplifier with Three Jacks and Plug for Telephones.

EMPLOYING THREE HONEY-COMB COILS.

(151) Mr. John Smith of Akron, Ohio, wishes the following data:

Q. 1. Will you publish a hook-up for three Honey-comb coils as follows; one primary, one secondary and one tickler, mounted in the manner shown on page 415 of February RADIO AMATEUR NEWS, and employing an audiotron bulb and suitable condensers?

A. 1. A suitable hook-up making use of the coils you mention is herewith publisht.

Q. 2. Will you describe briefly the construction of a tikker detector?

A. 2. A simple form of the tikker detector for the reception of undampt waves may be made by using a small battery motor, and by placing a fine steel wire lightly into the groove of the rotating metal pulley. The other wire may be connected to the frame of the motor. The rubbing of the steel wire against the pulley running at high speed will produce the required rapid make and break of the undampt waves, and this rapid make and break will be heard in the telephone circuit.

NEW MOUNTING FOR HONEY-COMB COILS.

(152) John H. Meredith of Chattanooga, Tenn., asks:

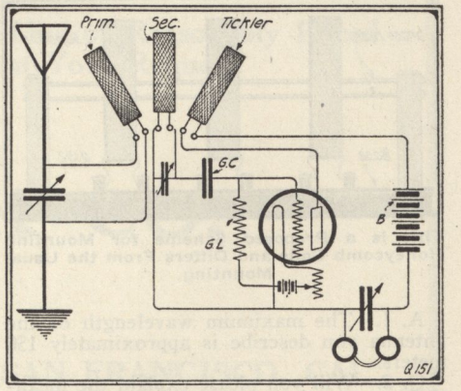
Q. 1. In recent issues of RADIO AMATEUR NEWS I noticed that in the De Forest Honey-comb coil mountings, the coupling is varied by means of hinges, and the coils swing upon an arc. Would it be just as well to secure the coupling by mounting the coils on horizontal rods?

A. 1. Yes, this method of coupling may be done just as well, altho the other was found more convenient and requires less space in the receiving cabinet. In this instance it will be necessary for you to insert a block of wood in the center of the Honey-comb coils, drill one or two holes in the block so that the coil may slide one way or the other upon brass rods and thus be variable in its mutual relation to adjacent coils. A suitable mounting of this type is shown in the accompanying illustration.

UNITS AND TENS SYSTEM OF TAPPING.

(153) F. D. Kirstein, of Pittsburgh, Pa., asks:

Q. 1. I am constructing a navy Type Coupler and would like to know the proper

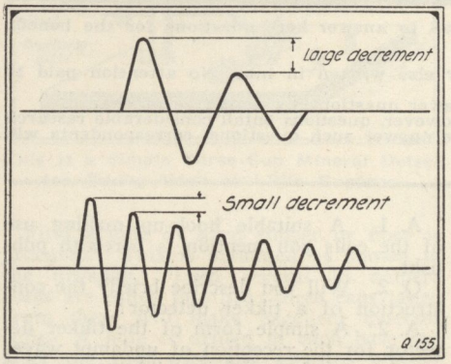


These Honeycomb Coils are Used as Primary, Secondary and Tickler as Shown in Diagram.

connections in taking off taps on the primary.

A. 1. You should employ the units and tens system of tapping the method of which is shown in the accompanying diagram.

Q. 2. What will be the wavelength of the coupler I am building, the primary of which is 5½" in diameter, 7" long and wound with No. 24 DSS copper wire and the secondary 4½" in diameter and 7" long, and wound with No. 30 DSS copper wire?



The Upper Diagram Shows a Highly Dampt Wave Train Having Large Decrement; the Lower Diagram is That of a Slightly Dampt Wave Train Having Small Decrement.

A. 2. The maximum wavelength of your lose coupler will be approximately 1500 meters. The length of the aerial you use in connection with this receiver, however, will determine the final wavelength, and if you insert a .0005 variable condenser across the secondary of the loose coupler your wavelength range will be considerably increased.

POCKET RADIO RECEIVING SET.

(154) L. F. Smith of Brooklyn, N. Y., asks:

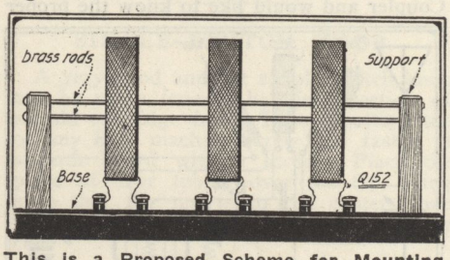
Q. 1. I recently bought the book "How to Make Wireless Receiving Apparatus" and on page 280 of which is a description of receiver entitled "A Vacation Radio Pocket Set." Will you kindly tell me what distance a set of this type is capable of receiving, using a one wire aerial 15 feet high and 150 feet long?

A. 1. A portable set of this type using the antenna you describe should have a receiving range of two or three hundred miles, possibly more under favorable conditions.

THE MEANING OF DECREMENT.

(155) Theodore Kramer of West Park, Ohio, wishes to know:

Q. 1. What is the wavelength of an aerial composed of seven No. 14 wires spaced one foot apart, 56 feet long, 27 feet high and 10 feet lead?



This is a Proposed Scheme for Mounting Honeycomb Coils and Differs From the Usual Mounting.

A. 1. The maximum wavelength of the antenna you describe is approximately 150 meters.

Q. 2. Will you please explain the meaning of the word decrement?

A. 2. The word decrement refers to the natural decaying of the amplitude of any dampt oscillation. The ratio of this decaying between each succeeding oscillation is said to be constant. The accompanying diagram shows a highly dampt as well as a slightly dampt wave train.

DIFFERENCE BETWEEN LONG AND SHORT AERIALS.

(156) Mr. Hyman Freiberg of Cleveland, O., wishes to know:

Q. 1. Is there very much difference between a two slide and a three slide tuning coil?

A. 1. There is no great difference as far as results are concerned. A three slide tuning coil makes it possible to secure various tuning adjustments. A two slide tuning coil will do quite well for all practical purposes.

Q. 2. What is the difference between a single pole and a double pole 80 ohm receiver?

A. 2. The double pole receiver is usually more effective on account of its better construction and the fact that two poles present a greater vibrating surface for the diaghragm. A double pole 80 ohm receiver of course is more expensive.

Q. 3. What is the difference between a two wire 60 foot aerial, and a one wire 120 foot aerial?

A. 3. The 60 foot, two wire aerial has a larger capacity, and therefore, present more capacity surface for the reception of waves, while the 120 foot, one wire aerial does not contain as much capacity, but has twice the wavelength of the former. The first is suitable for the reception of short amateur wavelength while the latter is more adapted for the reception of high or commercial wave-lengths.

SIMPLE WAY OF CALCULATING WAVE-LENGTH.

(157) The Secretary of the *West Philadelphia Boys' Club* wishes the following information:

Q. 1. Will you please publish in your columns a simple way to find the wavelength of an aerial?

A. 1. The approximate fundamental wavelength of an aerial can be secured by multiplying the length of the antenna, plus the lead-in, plus the ground connection, in feet, by four which will give the wavelength in feet. In order to reduce to meters the result should be divided by 3.3.

RECEIVING WITHOUT AN AERIAL.

158) A. Bell of Yonkers, New York, wishes to know:

Q. 1. Is it an extraordinary feat to receive signals without an aerial? Under most conditions I am able to hear distinct signals from N. A. H. (Brooklyn Navy Yard).

A. 1. No, this is not extraordinary. In fact it is quite a common occurrence. You are so close to the powerful naval station transmitter that the transmitting energy in your vicinity is more than sufficient to actuate even an ordinary receiver; in other words your lead-in is able to pick up sufficient energy.

RADIOPHONE OPERATING SCHEDULE.

(159) Herman Anton of New York City, asks:

Q. 1. Are radiophone signals being transmitted by any particular company in this vicinity, and at what time?

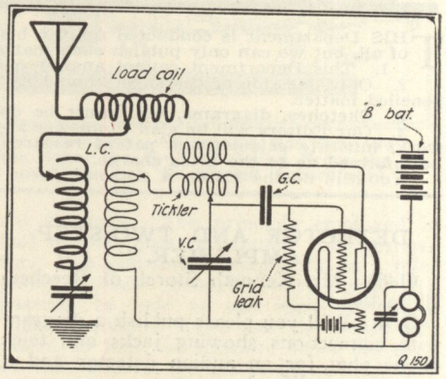
A. 1. There are several radio companies engaged in radiophone experiments in the vicinity of New York, among which is the DeForest Co., and the Western Electric Co., but we are not aware that these companies follow any particular schedule for operating. Today considerable radiophone experiments are being carried on by local amateurs on 150 and 200 meters.

Q. 2. Is it possible to hear radiophone conversation with the ordinary radio telegraph receiving apparatus?

A. 2. Yes, you should have no difficulty in hearing radiophone conversation providing you are in the vicinity of the stations.

OVERCOMING POWER LINE INDUCTION.

(160) Norman E. Truett, Secretary of the *Sedalia Amateur Radio Club,* wishes information on the following:



This Is a Regenerative Feed-back Circuit Suitable for Long Distance Reception.

Q. 1. My receiving station is located within 300 yards of the City Power Plant and my aerial is parallel to the power lines across the street. I am greatly bothered by interference from the generators, can you suggest a way by which this can be overcome?

A. 1. According to your description you evidently have erected your aerial so that it is in direct mutual relation to the power lines, which is of course a very bad practise. We suggest that you change the position of your aerial so that its length will be directly at right angles to the power lines.

TWO SIMPLE FORMULAE.

(161) John Gibson of San Francisco, Cal., writes:

Q. 1. Will you please give me the manner of ascertaining the frequency of a generator?

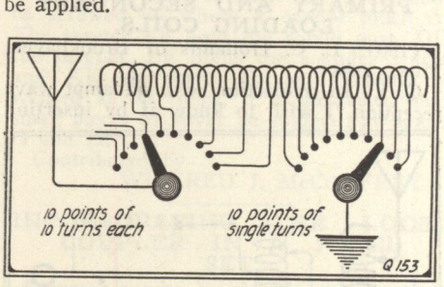
A. 1. The frequency of an alternator may be determined by employing the following formula.

$$N = \frac{P \times RPS}{2}$$

where P is equal to the number of field poles of the machine and RPS is equal to the number of revolutions per second.

Q. 2. How may one determine the necessary condenser capacity for a given transformer, and power supply?

A. 2. The following simple formula may be applied.



Illustrating the Unit-and-tens System of Tapping the Primary of a Loose Coupler.

$$C = \frac{W}{(kv)^2 \times N}$$

where C equals capacity in microfarads.
W equals power in watts.

(*Continued on page* 587)

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(I take the liberty of quoting your letter)

"Dear Madam:

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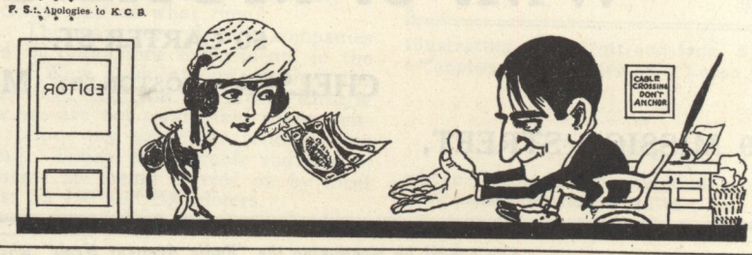
(Signed) H. GERNSBACK, Editor.

DEAR ED:
IT WAS awfully
NICE OF you
TO ANSWER me
SO QUICKLY
AND MANY thanks
FOR YOUR invite
BUT I simply
CAN'T THINK of
ANYTHING TO write
ABOUT.
THERE'S NOTHING new
ABOUT MY wireless
RINKTUMS
OR MY
DINGBATS
BUT ANYHOW
AND ANYWAY
I'LL THINK of
SOMETHING SOON
AND IF you'll
FIND TOO many
A'S
AND TOO many
THE'S
YOU'LL KNOW
THAT I'M short
OF FUNDS
FOR EVERY cent
COUNTS THESE days
AND IN closing
I MIGHT ask
IF YOU'LL pay
FOR THE dots
AND DASHES
BUT IF you don't
THEN NEVER mind
CAUSE ANYWAY
I HAD to
PRACTISE MY
CODE.
I THANK you.

DOROTHY KANTRO.

DEAR DO:
THANKS
AWFULLY MUCH
FOR YOUR
"PROSE-POME"
WHICH TAKES up
44 LINES
OF SPACE
BUT COULD
GO INTO 15
EASILY
THE OLD way
AND AS we
PAY 14
CENT A line
FOR FULL lines
NOT FOOL lines
WE DOPE
IT OUT
THAT YOU
MADE US
WASTE 29
LINES OF
GOOD SPACE
29 x 14
18.34.06
YOUR 103
WORDS
BRING YOU
$1.03
"HANDS" YOU
OWE US
$4.06—1.03 =
$3.03
PLEASE REMIT
SOON
I THANK you
YOUR
ED.

P. S.—Apologies to K. C. B.



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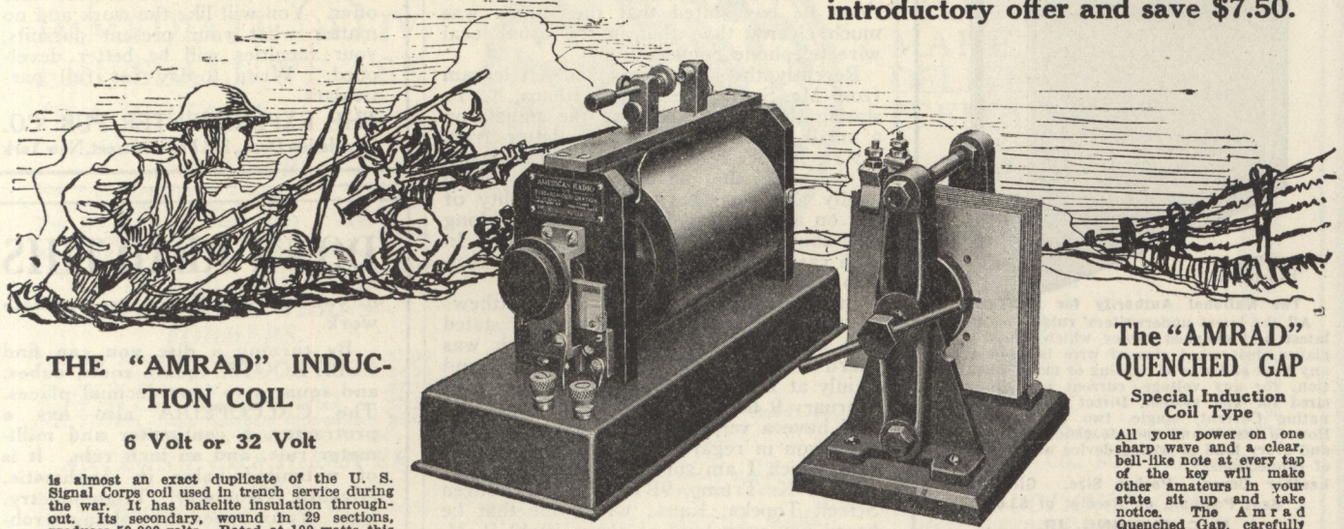

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"Amrad" Quenched Gap, " " . . .	**12.50**
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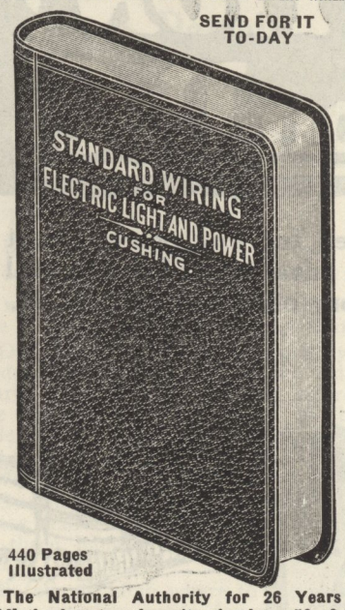

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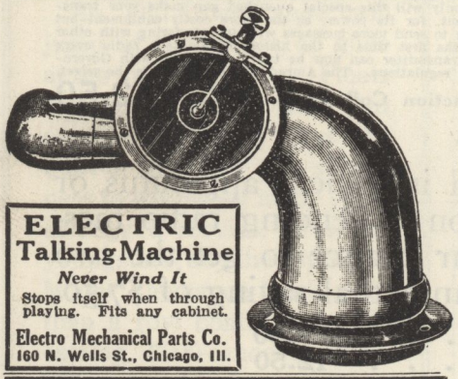

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A Modern Radio Telephone

(*Continued from page* 538)

ported the speech so strong, clear and distinct that he could not use a two-step ampliler because it hurt his ears. He said the writer's voice fairly SCREAMED at him.

Some letters mentioned particularly the voice inflections, how pronounced they were and one night Mr. Candler at St. Mary's, Ohio, ventured so far as to comment on the character of the speech, stating that the speaker's accent sounded like that of Western Ohio, since he didn't drop his r's as the people of New England do. Several times he has stated that the speech was much clearer than that in the usual local wire telephone conversation.

Recently the author has had a telegram from Mr. S. C. Sweeney, of Ithaca, N. Y., stating that he was getting the signals on a small indoor aerial; and a letter from 9 AH, Mr. F. N. Schnell, also of Chicago, to the effect that he is getting the speech loudly and clearly (with an audibility of 80) on an indoor aerial about 30 feet long and about 34 feet above the ground. In each case a regenerative receiver and two-step amplifier was used.

Subsequent letters from Mr. Matthews of the Chicago Radio Laboratory stated that he had reports that the speech was heard weakly at Valley City, N. D., and plainly at Baudette, Minn. In his letter of February 9 he writes as follows:

"I have a very interesting report to forward you in regard to the test of the 6th, with which I am sure you will be pleased. Mr. R. K. Trump, 9BT, 1254 Van Buren Street, Topeka, Kans., writes me that he heard you very loud at about 10:40 P. M. calling us with the buzzer, and that shortly thereafter he heard you working us on the phone and also heard your music. He reports that the music was fine, but that he could not understand a great deal of the speech because of local interference. This work is particularly unusual when you consider that Mr. Trump is at this time using a one-step amplifier on an aerial which is lying on the ground." (His antenna was blown down during the storm.)

Similar reports have come from St. Paul, Minn., Battle Creek, Mich., Fenton, Mich., Frankfort, Ky., Martensburg, W. Va., etc.

The different points at which the speech has been heard are shown by the dots on the map—Fig. 8. This, unfortunately, is somewhat misleading as to distance, since in comparison with a much larger map drawn to a scale of eight miles to the inch the distances as shown here are from one to three hundred miles less. It will be noted that circles have been laid off on this map 200 miles apart and that if the circles were continued to the coast the width of the United States would be represented as approximately 2,600 miles, whereas it is actually about 3,000 miles and more, of course, if the curvature of the earth is taken into consideration. In comparing a flat or mercator map with one drawn on a globular scale a difference of about 1.57 was found in the distance between New York and Chicago. Valley City, N. D., the greatest distance obtained so far, is represented here as about 1,300 miles, whereas the large map referred to shows it to be at least 1,400 miles and on a globular projection it would probably measure at least 1,500. However, the distances as shown here are conservative and the error is not of much importance. It will be noted from the number of spots in Ohio that there is apparently no difficulty in hearing the speech there. The points farther away are somewhat scattered and are much fewer, because of difficulty in stumbling into such a very sharp and weaker wave for which the stations were not listening.

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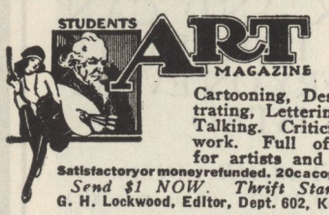

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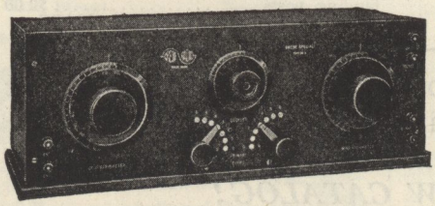

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Constructed according to the highest engineering and manufacturing standards.

This Instrument was fully described in Q S T for March, 1920, and may be found on display by the following concerns:

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From this map the reader will realize, no doubt, the possibilities that confront us in the transmission of radio telephonic speech. It is felt that the limit of the equipment being used has not been reached by any means, and it is hoped that it will be but a short time before reports are received from stations at much greater distances. It is apparently necessary, however, to arrange in advance for stations at such distances to listen because of the tremendous local interference existing at present and because of the sharpness of the wave transmitted. Arrangements are being made therefore to have amateurs in Texas and Nebraska listen for broadcasts sent out every other night at 11 o'clock New York time in order to approximate somewhat the actual condition under which a commercial equipment of this type would be required to work.

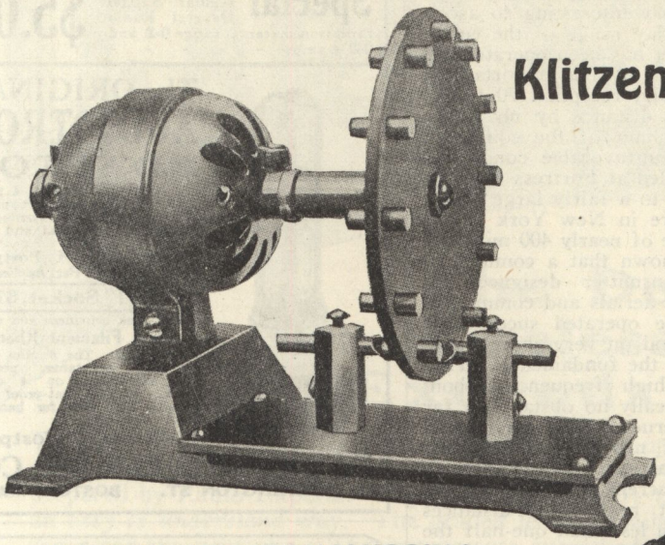
Attempts are also being made to get data from those listening as to the fading of the signals. Fading has always been one of the worst bug-bears that the amateur has had to contend with and is a "something" like static which, up to the present, we have been unable to explain. An amateur starts and in the middle of his message the signals suddenly begin to fade out until they disappear completely, only to gradually come back in again later as strong as ever. The evidence collected so far seems to indicate that the continuous waves sent out by the vacuum tube oscillator do not fade like the dampt waves from a spark transmitter. The evidence is far from complete, however, and there have been some instances where fading of the signals has been reported which may, of course, be inaccurate because the receiving operator is not accustomed to the reception of continuous wave signals, and therefore misinterprets as fading what is known as "swinging." This swinging is a slight variation in wavelength due to some capacity change in either the transmitter or receiver circuits which, because of the extreme sharpness of tuning, causes a change in the intensity of the signal in the receiving telephones.

The question of static or atmospheric disturbances is a large one which has been worked on for many years. In this connection it is interesting to note that one night while working with Mr. Matthews at Chicago he reported at the beginning of the tests about midnight that there was no static and that he was receiving the speech perfectly. At the same time in Ossining great difficulty was experienced in receiving him because of very heavy static. Towards the end of the test, however, an hour or so later, the conditions were entirely reversed, since he could not hear the author because of static and his signals were coming thru clearly to Ossining at which place the static had entirely disappeared. This would indicate the existence of what might be called a "static stratum" which was moving westward at the time.

There are other questions which come up in short wavelength transmission, a region which the writer believes is particularly valuable for the solving of atmospheric problems. For instance we should like to know why it is that for the greater part of a week at times it is impossible for amateurs here in the East to hear the Western stations, whereas there is apparently but very little difficulty in working North and South. We would also like to know why stations in the vicinity of New York cannot hear a station in Poughkeepsie without difficulty whereas Poughkeepsie can work the Western stations consistently without any trouble. The author believes that with proper organization and the assistance of the amateurs who devote so much time in trying to overcome these problems, some of these questions could be carefully studied and hopes to see such an organization with such a research in hand in existence before long.

In these particular experiments the author is greatly indebted to the amateurs in general and especially to Mr. Matthews of Chicago, and Mr. and Mrs. Candler in St. Mary's, Ohio, for without their untiring co-operation nothing could have been done.

Although the results obtained are generalities only, they are particularly valuable because the work has been done without prearrangement and with strangers on wavelengths for which they were not listening. These are very different of course from actual test conditions and from commercial operating conditions. The most unusual part of the work is the amount of power used. With the exception of one or two tests, the plate input did not exceed 300 watts, and in any case it has never exceeded ½ K.W. Chicago has been worked repeatedly on 285 watts and Little Rock, Ark., reported the buzzer modulated signals very loud when using this input. These figures are very surprising when one considers the very inefficient way in which the equipment is being worked.



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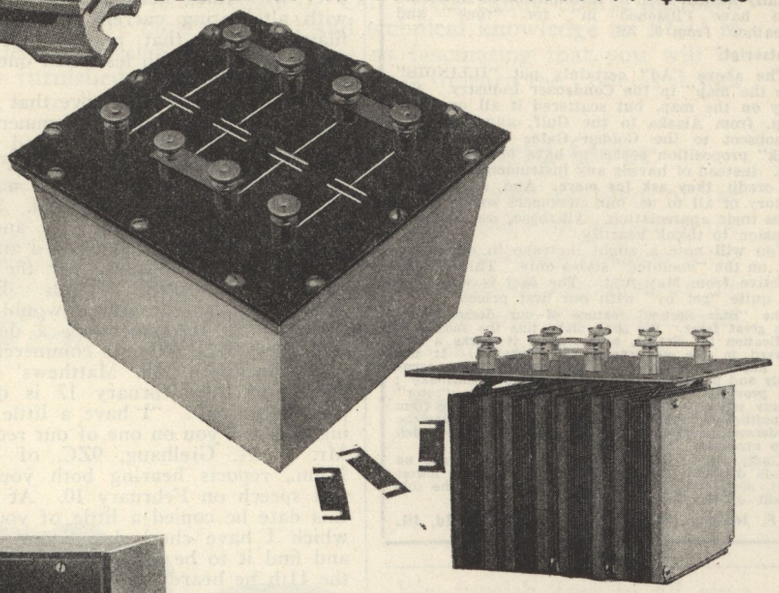

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This condenser is made adjustable to suit the varying conditions of various transformers. Its capacity is variable in steps of about .00238 M.F.D. from .00238 M.F.D. minimum to .00953 M.F.D. maximum. The engraved cover makes it easy for the amateur to use any hook up desired. The dilectric which we use will withstand a puncture test of 40,000 volts. Tests in our laboratory show that transformers offered to the radio field at the present time are unable to break down this condenser under the severst tests. The four sections are contained in an aluminum casting filled with Atlas AA special insulating oil.

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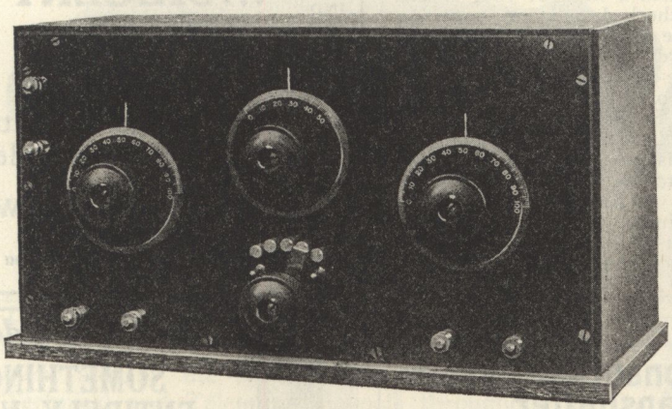

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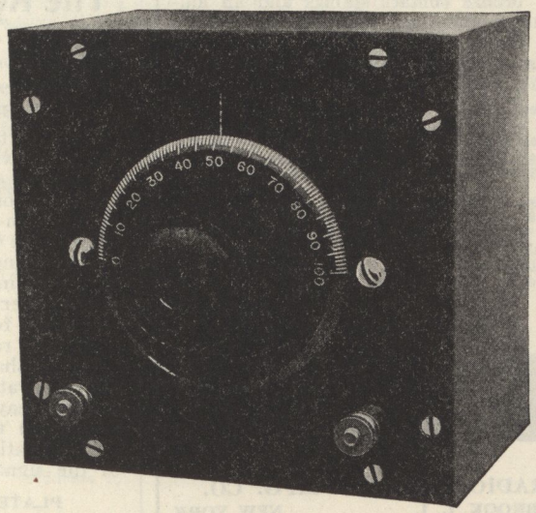

IF YOU HAVE NOT RECEIVED OUR CATALOGUE "C" WRITE FOR IT.

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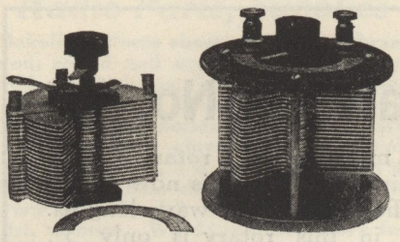

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Three Styles, No. 1. Panel, No. 2. Open Type as shown, No. 3. Fully Encased. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

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Style	No. 1	No. 2	No. 3
43 Plates,	$3.00	$4.00	$4.25
23 "	2.50	3.50	3.75
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In Canada 25c additional

Money back if not satisfied. Just return condenser within 10 days by insured P. P.

These condensers are made by a watch mechanic schooled in accurate workmanship. Personally we will need no introduction to Amateurs who have "listened in" for "time" and "weather" from 9. ZS.

Postscript.

The above "Ad" certainly put "ILLINOIS" "on the map" in the Condenser Industry. Not only on the map, but scattered it all over the map, from Alaska to the Gulf, and from the Penobscot to the Golden Gate. The "money back" proposition seems to have been superfluous. Instead of having any instruments returned for credit, they ask for more. And, most satisfactory of all to us, our customers write to express their appreciation. All these, we take this occasion to thank heartily.

You will note a slight increase in our price list, on the "meunted" styles only. This will be effective from May first. The fact is we could not quite "get by" with our first prices.

The "Star Spring" feature of our design meets with great favor. We shall make this the subject of application for Patent, as we think it marks a step forward in the construction of Variables. It has two important functions. It keeps the plates accurately and permanently centered; without "endshake"; and provides sufficient friction to hold the "rotor" at any setting without liability of its dropping from its position by the unbalanced weight. It makes the Condenser, in this respect as reliable as the much more expensive "balanced" type.

Kindly note: We issue no Catalog, and make no "trade discounts." We set our price at the lowest limit, and leave the "middle man" out for the sole benefit of the "consumer."

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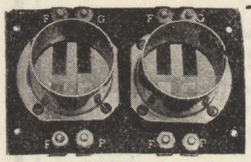

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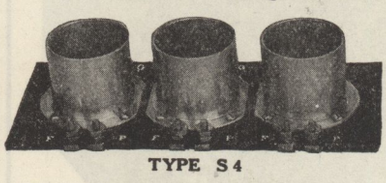
A grade XX Bakelite Dilecto base, the best insulating material known, flat phosphor bronze contact springs and an aluminum socket, not cast, but spun from hard sheet aluminum. The complete unit so assembled as to always make perfect contact with your bulb.

These Receptacles were not designed to meet price competition, but constructed to give you the best obtainable no matter what price you pay.

Type S1—Single Tube (for inside mounting).....$1.20
Type S2—Single Tube (for bench and experimental use) 1.75
Type S3—Double Tube (for amplifier use)..... 2.75
Type S4—Triple Tube (for detector and two-stage amplifier or three-stage amplifier use).... 3.75

The above receptacles are all made in two styles, for either receiving or transmiting tubes. This should be specified when ordering.



TYPE S4

RADIO SERVICE & MFG. CO.
LYNBROOK, L. I. NEW YORK

It is regrettable that lack of time prohibits but very few daylight tests, as it would be particularly interesting to ascertain definitely the day range of the equipment. Altho the set has been operated but two or three times in daylight, reports have been received of loud reception 70 to 100 miles away, which distance by no means appears to be the limit of the equipment under the present unfavorable conditions. A similar set installed at Fortress Monroe, Va., and connected to a fairly large aerial, has been heard here in New York in the day time, a distance of nearly 400 miles.

The work has shown that a commercial type deForest transmitter designed for comparatively large aerials and commercial wavelengths can be operated successfully on a small aerial and on very short wavelengths, even below the fundamental. That working at such high frequency (about 900,000 cycles) is really no obstacle as far as stability is concerned. That commercial speech as good, if not better, than that over wire lines may be transmitted even with alternating current for lighting the filaments, and that remarkable distances can be covered with less than one-half the power available.

It follows from the above that it is conservative to estimate the commercial telephone range during daylight and under all conditions of a one kilowatt deForest set at 200 miles when commercial aerials 150 to 200 feet in height are used. The telegraph range is probably one and a half times for the buzzer modulated and two to three times this distance for the continuous wave telegraph signals. Based on these tests also the author would have no hesitancy in recommending a deForest 2 K.W. set for a 300-mile commercial range.

In conclusion Mr. Matthews' most recent letter of February 17 is quoted in part. He says: "I have a little interesting data for you on one of our recent tests. Mr. G. A. Gjelhaug, 9ZC, of Baudette, Minn., reports hearing both your buzzer and speech on February 10. At 10:30 on this date he copied a little of your speech which I have checked with our own log and find it to be O. K. At 11 o'clock on the 11th he heard you again, but could not read you because of static. He also reports that a little later on the same night he heard your music. As Baudette is located almost on the northern border of Minnesota, this is pretty fair distance. The next station that I will try to get for you is 5ZA, at Roswell, N. M. If he hears you successfully, the next jump will be Los Angeles, and I am almost beginning to believe that you will make it."

(An abstract of a lecture before the New York Electrical Society, February 26, 1920.)

The Resonant Converter Transmitter

(*Continued from page* 545)

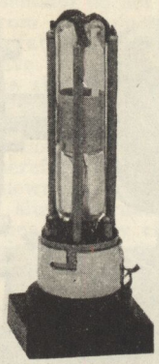
BUZZER MODULATOR.

Vacuum tube sets used for telegraphing at short waves have used an ordinary buzzer for operating the modulator tube. The common form of buzzer is rather inconstant in its operation and cannot deliver but a minute amount of power without changing its tone. On the other hand the pure sine wave delivered by the resonant converter at any desired voltage and frequency forms an ideal means of modulation for radio telegraph purposes due to the clear sharp musical tone produced. For the few watts needed for modulation a resistance may be inserted in the supply line to control the input and vary the degree of modulation and therefore the strength of the signals produced. See Fig. 5.

PLATE POTENTIAL GENERATOR.

Vacuum tube development has indicated

Special While they last, regular $10.00 General Radio radiation meters; range 0-2 and 0-2½ amps - - - - - - **$5.00**



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$1.75 EACH Postpaid Pat. Applied For

New "VT" Socket, $1.00

One look convinces you our **Paragon Filament Rheostat** is the best. The 6 ohm non-oxidizing resistance, permits fine adjustment on 4 or 6 volts. Cast in heat-proof Condensite 2¼" dia. for back or front mounting.

$1.75 Each, Postpaid

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Switch Points FREE!

For five cents, to cover cost of packing and mailing, we will send one nickel plated brass switch point and nut free. If requested this amount credited on first order for two dozen at regular price of

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These points are same type as used on first-class commercial apparatus, measuring approximately as follows—

Head ¼"x⅛" Shank No. 6x¾" screw.

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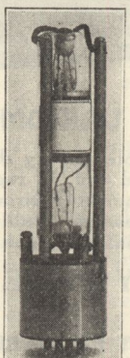

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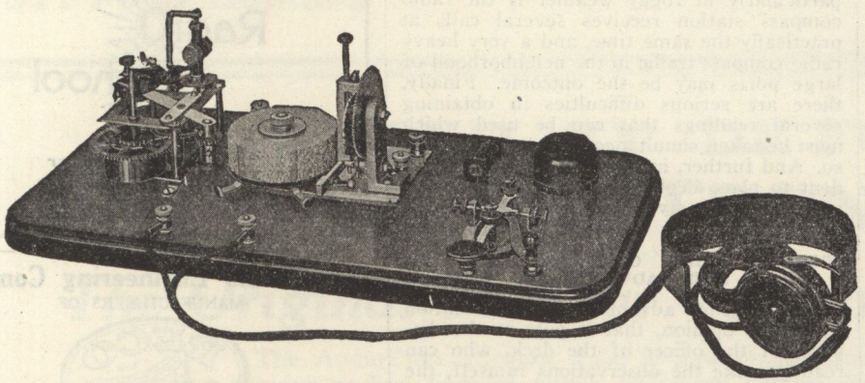

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that the use of high plate voltage is very desirable, particularly in transmission work. This may be obtained from costly DC generators or by rectifying high voltage AC.

The British Navy has followed the latter practise and during the war developed many tube transmitters using 5,000 to 10,000 volts on the plate. This was obtained by stepping up an AC voltage to the required value and employing several rectifier tubes. The resulting DC is then smoothed out by a condenser.

For this work the Resonant Converter principle is again very well adapted since the capacity of such a rectifying scheme depends greatly upon the frequency of the AC source used.

The circuit diagram in Fig. 6 shows how the resonant converter changes the DC supply to the proper frequency which may vary from 500 to 2,000 cycles. The transformer has a mid tap on the secondary winding so that both halves of the wave may be stored.

The high potential rectified current is then tapt from the terminals of AA after being smoothed out by the working condenser K.

From the foregoing statements specially prepared by the inventor it will be seen that the resonant converter has several distinct advantages over other similar devices in that it may be employed for purposes not possible with other machines.

Application of the Radio Compass to Navigation

(*Continued from page* 542)

particularly in foggy weather if the radio compass station receives several calls at practically the same time, and a very heavy radio compass traffic in the neighborhood of large ports may be the outcome. Finally, there are serious difficulties in obtaining several readings that can be used which must be taken simultaneously or very nearly so. And further, in heavy weather it is prudent to place dependence on positions only when they are given for three positions of the ship.

SECOND: RADIO COMPASS ON BOARD SHIP—ADVANTAGES.

The principal advantage of this solution is, in our opinion, that it puts at the disposal of the officer of the deck, who can readily make the observations himself, the instrument which serves to determine his position. In addition, it is now possible to take bearings on any station heard, which fact greatly increases the number of bearings that can be used *without increasing the interference*. The quality of the bearings will always be good except perhaps in directions too close to a straight coast line, but practise will soon give all the useful information on this subject. Finally, the radio compass on board ship becomes a valuable aid in heavy interference for receiving telegrams when traffic is abnormal, and the position of a ship in distress may be determined immediately.

DISADVANTAGES.

The installation on board ship is less easy than shore and a suitable location must be chosen so that the bearings taken will not be false indications of the true direction. This last condition is not really difficult except on warships with particularly high superstructures which accentuate the diffraction and polarization of the waves. At the present time radio compasses are confined practically to shore installations, but this is caused by the initial difficulties and we are certain that the radio compass will become an important factor aboard ship in the future.—*Abstracted from Director of Naval Communication Bulletin.*

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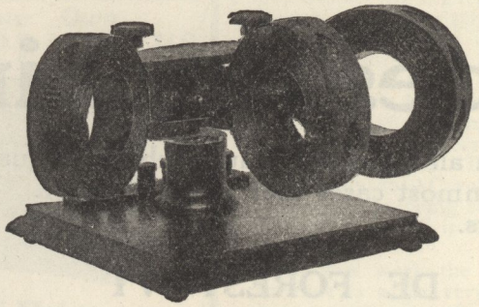

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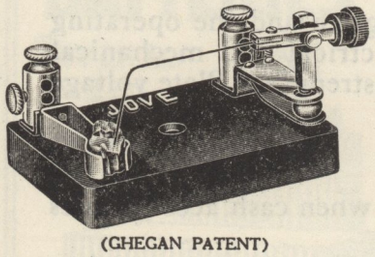

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Radio in Modern Aircraft

(*Continued from page* 539)

true beacon-line of flight will cause a marked difference in signal strength.

For bearings on arc or undampt stations a separate heterodyne is employed, calibrated for all wave lengths in use. This is placed over the box containing the condensers, and other apparatus mentioned above. A feature of this system of Direction Finding for Aircraft is the fact that the *maximum strength* of signals is used to take a bearing in contra-distinction to the *minimum* method usually employed in direction finding work and which gives no indication if the beacon station ceases transmission.

Exhaustive tests were carried out by the writer during flights near London to determine the range and degree of accuracy of the equipment when positions were determined on groups of stations heard.

The remarkable sensitivity of the system is shown by the fact that a position was determined by means of signals heard from Balboa, Tuckerton and Clifden (Ireland). Other groups successfully used were Cairo, Constantinople, and Moscow; Pola and Coltano; Paris and Coltano; Rome and Madrid; Nauen and Stavanger, and certain other smaller stations.

A switching scheme is provided to ensure fully charged storage batteries which are charged from a windmill-driven generator giving 12 volts at 20 amperes and which also provides current for "heated" suits for the pilot and navigator if necessary.

Timing Torpedoes By Radio

(*Continued from page* 543)

detector, fixt stopping condenser and telephones.

The radio boat takes up a position close to the target—with the operator on watch for signals.

On the bridge of the firing ship is another operator with telephones connected to the main or an auxiliary set. When he hears the dull thud of the torpedo leaving the tube he presses the radio key and at the same instant notes the time of his watch. The operator in the distant small boat hears the radio dash in his 'phones and also notes the time on his watch.

The minute the bubbles are sighted the men rapidly turn the handles of the generator and the operator signals QRX (stand by). The instant the torpedo passes under the target he presses the key and the waiting operator on the big ship notes the position of the second hand of the watch. Then follows a report by radio (which means hard work for the men working the generator) whether or not the torpedo was a bull's-eye or miss, and if a miss, how many feet to the right or left of the target it past.

Sometimes something goes wrong with the mechanism of the torpedo and it broaches (comes up) before the target is reached and then all hands in the boats anxiously watch its movements, as well they might, altho harmless as far as an explosion is concerned, traveling at such a high speed it could easily smash a boat to pieces and throw the occupants into the water.

The writer remembers such an occasion when the torpedo broached 200 ft. in front of the boat, then partly submerged again and struck the bottom of the boat with such an impact that the boat was partly

lifted out of the water and one man thrown overboard. Luckily he was an expert swimmer and none the worse for his experience.

The spent torpedoes are towed back to the ship and hoisted over the side and made ready for further practice, or stowed away, as the case may be, while the operators and crew are wondering what is awaiting them in the form of "chow."

A Precision Micro-ampli-fone

(*Continued from page* 546)

buzzer as usual, at the same time turn the precision knob and rheostat regulator until maximum audibility is obtained.

The precision micro-ampli-fone is now in a supersensitive receptive adjustment and will vitalize the last iota of flux from any vagrant wireless wave that may aspire to roost upon a heretofore silent antenna.

An Unexpected Circuit

(*Continued from page* 549)

given a tone quite different from the real note of the spark.

It is possible that this effect may be worth investigating farther, but I hardly think it can be made practical, for several reasons. One objection, though not serious, is that the howling note is unpleasant to the ear. Another is that absolutely sharp tuning would be necessary, for if two stations easily distinguishable in ordinary reception were coming in together, they would be hopelessly confused by this howling effect. Both would have the same audibility and the same note if they could be heard at all. For the same reason any static disturbances would completely interfere with the signals you were trying to receive.

DISCARDED BATTERY JARS FOR MOUNTING WIRELESS APPARATUS.

The writer has found it both convenient and profitable to utilize broken hard rubber battery jars for mounting wireless apparatus or in many other instances where hard rubber or composition is used.

These jars can be procured from any battery service station for little or nothing, as a jar that has even a small crack in it cannot be used again in a battery and is thrown aside.

Heat the jar until it becomes soft and flexible by immersing in boiling water. With a pair of scissors cut the sides out of the jar and you will have two strips of rubber about five by seven inches square. Warm the strips and place between two flat boards to straighten.

The tar which may be left on the jars can be neatly scraped off with a putty knife and the rubber washed in gasoline to remove unsightly particles.

Any desired thickness can be obtained by placing a number of strips together, usually three such strips will be sufficient in most cases.

To fasten strips together, place them one on top of the other as evenly as possible and clamp in a vise. Bore holes around the outer edges and fasten with small stove bolts. True up sides with a square and grind down on an emery wheel or with a file.

The reader will not find this a very hard task and with a little practise it can be done very easily.

Contributed by B. F. WING.

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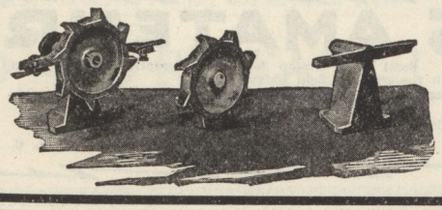

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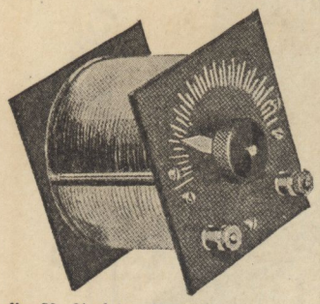

The rotary variable condenser is a necessity for all experimental wireless work and one or two of them are to be found in almost any wireless station. The two most popular types are the 43 plate and 21 plate with capacities of .001 mfd. and .0005 mfd., respectively. The large size has 21 rotary aluminum plates and 22 stationary aluminum plates. The small size has 10 rotary and 11 stationary plates. The ordinary rotary variable condenser is mounted in a cheap round metal case with a cheap composition top and coarse scale. Its plates are 0.15" thick and the shaft is 3/16" in diameter.

The "Tewno" Rotary Variable Condenser has two genuine "Formica" ends, a clear glass case, a ¼" shaft and plates .024" thick of a special grade of aluminum. However, the biggest feature in favor of our condenser is the form of end-piece used. It is square, facing the operator. It is not necessary to look over one's hand to see the scale, as was the case in the old upright type of condenser. The scales on these instruments are calibrated to 2½ degrees.

We recommend our 43 plate condenser for primary and secondary tuning on sets of fair range and for use in oscillating circuits. Our 21 plate condenser is well adapted to short wave tuning for use in small wave meters and a great variety of work calling for a small variable capacity.

Do not be fooled by an instrument that is "just as good." These are to date the best condensers on the amateur market.

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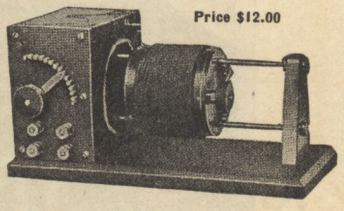

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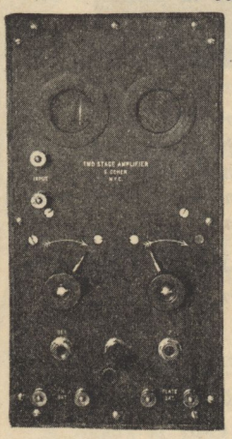

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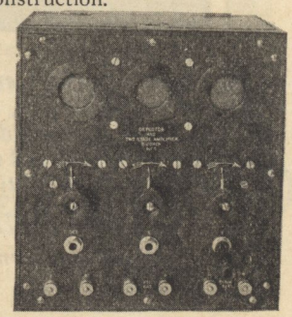
Instructions and wiring diagrams accompany each Amplifier.



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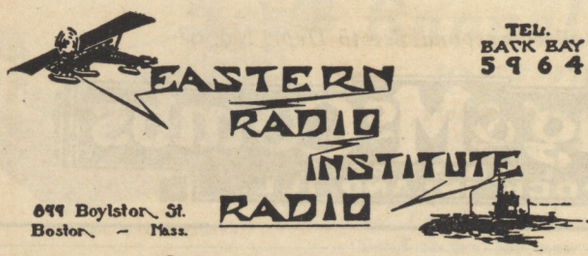

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THE BARR MERCURY-CUP DETECTOR **Dept. B, The Wyoming, Washington, D. C.**

Some Observations And Advice--Take It Or Leave It

(*Continued from page* 561)

hasn't forgotten you, he finally gives you the dope. There is a long pause and he eases you the address spelled in two different styles. This gives you a nice alternative and selection and he finally gives you the correction which does not match either of the first names sent. At last with a little imagination thrown in you O. K. for the works, and receive in return the ...-.—— five or six times to let you know the communication is finished! How well you know it. You are then about ready for a drink of Moxie yourself. The way to overcome this is to practise calling and sending sample message or the message beforehand on a practise buzzer until you can go thru with it and sure you can put it on the ether without making old Samuel F. Morse turn in his grave.

Closely related to this bird is the receiving operator, who, if he misses out, comes back with the old stall QRM—QRN or "Detector out." If you need a repeat, ask for it. It is not a crime to have to ask for a ..--... The best of operators have to ask for repetition at times and are glad to give a QTA for the asking. Besides, there may be some other ship very near you who had no QRM or QRN either.

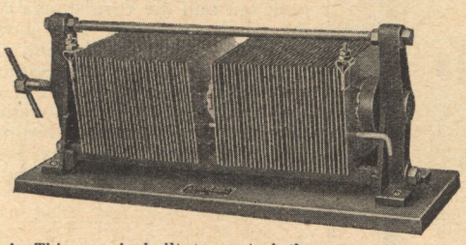
Now by this time I hardly need touch on Superfluous Signals of course; there are always operators who are at the "Like-to-send-a-lot age." They have not had enough of it yet, poor dears! About all they do is sit back and think up excuses for opening up with some monstrosity and disturb some of the old brass pounders who are thinking of retiring next trip, on account of old age.

THE RADIO JUNK PALACE.

The last topic is not related to the foregoing but one which needs attention. It concerns the interior decorator. This is a person who was cut out for a window trimmer instead of a wireless man. His radio room on first sight looks like a museum or floating hall. On closer inspection, however, you probably see signs of wireless apparatus sticking out through the postcards, pennants, smoking sets, and other trinkets, etc. This I believe is to camouflage as far as possible all indication of the presence of radio apparatus, and makes the place look like a nursery. But the greatest sight of all is to see him dig in under the debris of general flotsam in an effort to find the key when a call comes in. That is, if a call can find its way in, especially as far as the telephones. Then there is another brand of operator who adds many appliances which it seems to me have no particular function except to make the words look more mysterious to the public. This Bird will have a collection of dry cells, buzzers, toy motors, bells, etc., interwoven and festooned with many, many wires of various description running around the lay-out. This of course makes passengers and visitors exclaim: "Isn't it wonderful, this wireless affair, and can you really send messages through the air with it?" If you are an amateur ashore, the neighbors will say when they see your lay-out: "Why, isn't Horace a smart boy!" In that case you want to have a key concealed under the carpet to send in order to fake up a convenient message because there might not be anything stirring in the air at just that moment. *There never is when you have company* who would like to listen in. How well I know it. I have been through some of those periods of the game myself. Well to come back to the subject make the Radio Office on land and sea a place for radio

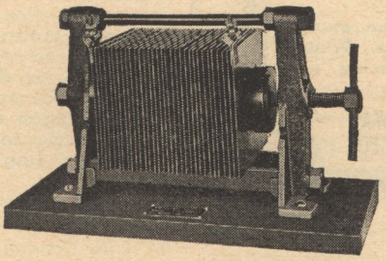
At Last! Immediate Deliveries on All

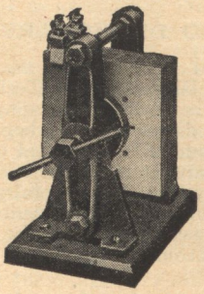
AMRAD QUENCHED GAPS



TYPE G-1—This gap is built to control the energy necessary to do real long distance work, 1,000 miles and over. It has 32 sparking chambers. Designed for use with transformers delivering 20,000 volts up. Maximum power 1,000 watts. Price, $26.50.

TYPE G-2 — Our first gap. Out only four months, it is now in operation in every U. S. A. radio district and in Canada. No inducements offered to introduce this gap; every user a voluntary purchaser. Enthusiastic reports on file in our office. Intended for moderately long distance work, 500-900 miles. It has 16 sparking chambers and is designed for use with transformers delivering over 10,000 volts. Maximum power 500 watts. Price, $17.50





TYPE G-3—Especially designed for use with the Amrad 100 watt induction coil, but is suitable also for use with ordinary spark coils or small transformers delivering over 7,500 volts. This gap will increase the range of any induction coil set and at the same time will permit the operator to comply with the Federal law regulating decrement. It offers the only practical solution to the QRM problem in congested districts. Seven sparking chambers. Maximum capacity 250 watts. Price, $12.50.

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Adjustable Resistances: To operate quenched gaps efficiently on 60 cycles a. c. an adjustable resistance must be used. We furnish three types of adjustable resistances. Prices and description of complete mounted units and parts contained in Bulletin Q.

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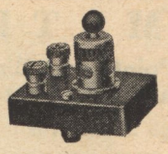

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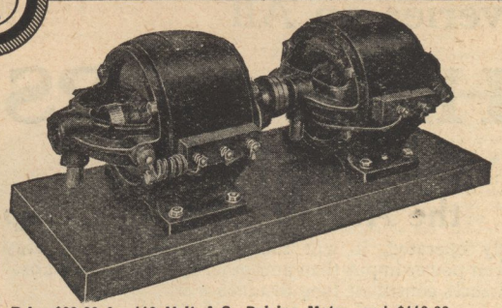

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This unit has a normal output of 100 watts (200 milliamperes at 500 volts) with a voltage range of 200 to 500 volts. The generator is compounded to insure constant voltage under variable load. It is furnished to operate on either D.C. or A.C.; a shunt motor being supplied for D.C. and an induction motor for A.C. The generator is equipped with a commutator of 48 segments reducing the commutator hum to a minimum.

Unit is complete with insulating coupling and mounted as illustrated on a finished base 8" x 20". Shipment can be made immediately.

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Prices subject to change without notice.

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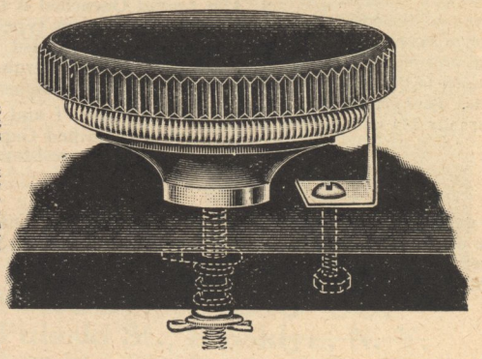
This rheostat is a new departure in rheostat designing, combining, as it does, the low cost of a front designed rheostat with the advantages and neatness of a back-connected instrument.

The resistance element is mounted on the back of the Bakelite knob in a groove provided for that purpose. Resistance is 5 ohms. The rotation of 360 degrees allows extremely close adjustment. Taken all in all we do not believe that this piece of apparatus can be surpassed by any other on the market today at anywhere near the price.



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apparatus and not a fancy parlor. Keep the operating table clear and give yourself a chance to manipulate the set without being all crampt up with paraphernalia on every side. Articles such as books and telegram pads not in use should be stowed away or piled up neatly to one side. Licenses and other things that must be posted, should be framed and neatly secured to the bulkhead. Keep all of the unnecessary junk out and the furnishings consistent and the whole outfit will look a whole lot better. More business-like and ship-shape.

When you see a tidy Radio Room with the apparatus in clean and bright condition you can bet dollars to doughnuts that the operator is getting fine results out of the set. It promotes efficiency, and that is the big word now-a-days in Radio as in everything else.

TWENTY-FIVE CENTS A MINUTE.

Announcement has just reached the United States that a regular radiophone service has been established between England and Holland. The charge for this service is 25c. per minute. It is said that the service is finding considerable popularity and the organization responsible for this innovation is planning to establish a similar service to other nearby nations such as France, Italy, Norway, Denmark and Belgium.

Editor's Note.—The day is drawing nearer and nearer when we shall have New York to London or Paris radiophone communication.

OUR RADIO DICTIONARY.

On page 563 of this issue is the continuation of the Dictionary of Technical Terms Employed in Radio Telegraphy and Telephony. This dictionary was begun in the March issue, and it is suggested to the young men who are starting their career in radio telegraphy that they carefully preserve each one of these instalments for they will appear each month until the complete dictionary from A to Z has been publisht.

A good way to preserve these words is to cut out each page containing the words and paste them or insert them in a loose leaf book or any form of book which will answer the purpose. In this manner the book can be kept handy in the operator's den and can be referred to at any time the occasion requires it. Not only this, but if new and additional words should be met with in future practise, these words and their meaning can be included. This arrangement should result in a very compact and satisfactory radio dictionary.

Underground Radio In Holland

Continued from page 547

As for myself, I believe that when transmitting stations will be built so as to transmit high frequency energy thru the ground, instead of the present overhead antennae, general radio construction will be much simpler and more economical than is now the case. Losses of energy will be greatly lessened and static will be a thing of the past.

As for other amateurs the world over a large field of experimentation has been opened. I feel sure many interesting articles concerning ground radio telegraphy will soon appear in the pages of RADIO AMATEUR NEWS.

Ed. Note: Let us hear from England, France, Italy, Australia, Canada; in fact from anywhere, on this subject.

Beat Reception

By L. W. AUSTIN and W. F. GRIMES

U. S. Naval Radio Research Laboratory

EFFECT OF REGENERATION.

According to some authorities, the great sensitiveness of the oscillating tube is mostly due to its regeneration, while, according to others, the sensitiveness is inherent in the beat method. With the autodyne the two factors are impossible to separate, but with the heterodyne this can be done. The experiment was made as follows: The regular laboratory long wave set with magnetic back coupling and without grid condenser was used, but with the back coupling much too loose for local oscillations. Oscillations were then produced by a separate heterodyne and audibilities taken on Nauen, the heterodyne coupling being adjusted to give the best signal. Then the back coupling of the regular set was increased to a point just before autodyne oscillations were set up and where with spark signals strong regeneration would be noted, but no increase in Nauen signals was observed even with retuning. The removal of the plate coil and bridging condenser from the receiving set, thus reducing it to a primitive audion, also had no effect.

Next, with a heterodyne coupling too loose to give the best signal, autodyne regeneration increased the strength of signal; that is, it seems that the back coupling of the receiving set regenerates the local oscillations so as to bring them up to optimum value, but has no observable effect on the strength of received signals. It may be that the resultant increase in sensitiveness due to regeneration and that due to oscillation is the sum rather than the product of the two, so that when they are added, the smaller increase due to regeneration is hidden by the great increase due to the oscillations.

BEST STRENGTH OF LOCAL OSCILLATIONS.

For the range 1/5000 audibility, the best signal is obtained with the same strength of local oscillations for any given circuit and wave-length. The optimum value varies with different vacuum tubes and with different ratios of inductance to capacity, increasing with increasing capacity.

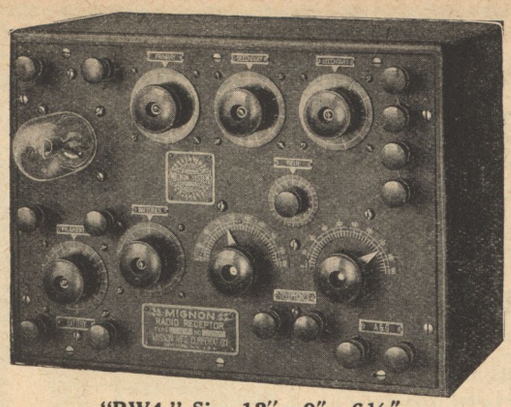
LAW OF RESPONSE AND AUTODYNE AND HETERODYNE.

In 1915, it was discovered, that the law of response of the oscillating tube (autodyne) within the limits of observational error, was linear, that is, that the telephone current was proportional to the first power of the radio frequency received current in the antenna, instead of proportional to the square, as in the non-oscillating tube, the crystal, electrolytic, etc.

Recently experiments have been made which prove that the linear response law holds for tubes and also for crystal detectors when local oscillations are produced by a heterodyne. Dr. J. M. Miller has suggested that the linear law might not hold if the local oscillations were very weak, for example, if excited by a heterodyne with very loose coupling, but experiment shows that even here there is linear proportionality within the errors of observation.

INTRODUCTION OF RESISTANCE IN THE OSCILLATING GRID CIRCUIT.

It was discovered in 1915 that if an oscillation vacuum tube (autodyne) be coupled to an antenna or loop, any amount of resistance can be introduced in the secondary circuit without reducing the strength of signal, provided the back coupling be



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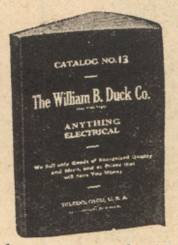

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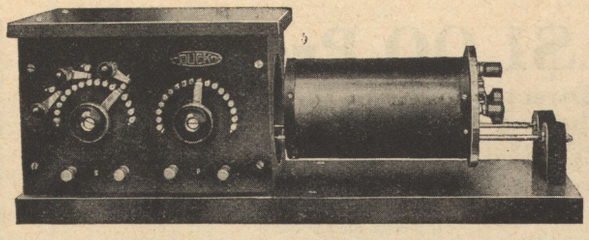
This edition of our wireless catalog is the most complete and elaborate we have ever put out. It embraces everything in wireless worth while. As an encyclopedia of information it is invaluable. It is printed on excellent paper and with a beautiful cover. Your amateur friend will tell you that there never has been any wireless catalog to take the place of Duck's, and above all that you can absolutely rely on the quality of every instrument listed in this catalog. In a word it is all worth while catalogs in one.



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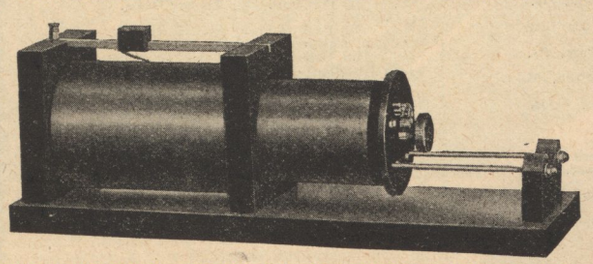
Secondary divided into three sections, with two dead end switches, eliminating harmonics. The change in the construction of the guide rod support makes it possible to obtain a looser coupling. It is a wonderful improvement over our old model both in performance and appearance. Only $23.50.



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The secondary on our new type Arlington is divided into three sections with two dead end switches, eliminating dead end effect and harmonics and giving greater selectivity. The end support is similar to that on our Navy type permitting a looser coupling. It is a beautifully finished instrument

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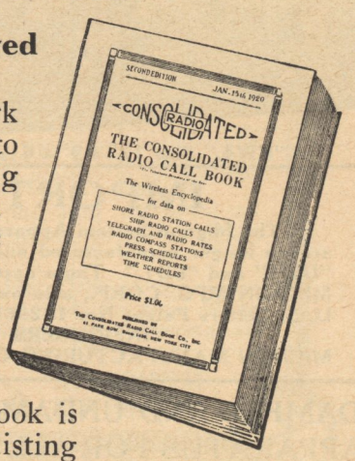

owing to the vast amount of work involved in bringing it right up to date and in compiling the big amateur section that will be a special feature. We urge all those who have placed their orders to be patient—you'll be glad you waited when you receive your copy, which will be very soon.

The Consolidated Radio Call Book is the only book in print officially listing all the radio calls as issued by the Bureau of Commerce. Every vessel and land station in the world is represented and listed alphabetically, according to names of vessels or land stations, and according to call letters; Revision of American coastal stations under U. S. Naval control, and their new calls.

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strengthened so as to keep the local oscillations at the same strength. This resistance may amount to many thousand ohms, while a small fraction of this resistance, if placed in the antenna or loop circuit, will reduce the signal to silence. Recently it has been found that the same is approximately true with a plain vacuum tube, and even with a crystal detector, when excited to local oscillations by a heterodyne.

In the early experiments the phenomenon was ascribed to a negative resistance action, but this is hardly possible, since the grid circuit is out of tune with the signal, and of course the explanation could hardly be applied to the heterodyne or crystal. As a consequence of the above facts, it follows that with an oscillating receiving tube connected directly in a loop, the strength of received signal is independent of the loop resistance. This has been verified by experiment.—*Bureau of Standards Circular.*

MARCONI CALLING DEVICE.

Recent tests involving the use of a radio calling device were carried out at Chelmsford, England, with remarkable success. Impulses sent out from the Shelford station caused the ringing of an ordinary electric bell and the exploding of small mines at the Chelmsford Station.

The device involves the use of a series of dots regularly transmitted at the rate of 180 per minute. This number was chosen as not being too fast for the operator to count and time, and as too slow to be interferred with by ordinary transmissions. Many experiments were carried on in order to obtain a relay which would respond only to the pre-determined signal and which would be operated by the change in currents produced by the reception of such a signal.

The final design is similar to the ordinary moving needle galvanometer. Two rectangular hollow forms, each wound with many turns of fine wire, were placed one above the other on a brass base, the windings being connected in series, and the free ends being taken to two insulated terminals in the base. In the rectangular orifice of the coils was placed a small ring magnet pivoted at its center and supported in jeweled bearings a five platinum tipt steel arm was fixt on the pivot at right angles. The arm formed one pole of a switch while the other poles consisted of a small piece of hard carbon.

The relay was so adjusted that the arm oscillated at the rate of 180 complete periods per minute. Unless the transmitted impulses arrived at the right moment and allowed the swing to be built up from zero to full, contact was not made.

An arrangement was also provided for permanently closing the alarm circuit once the contact had been made.—Abstracted March *Wireless World.*

IMPORTANT NOTICE CONCERNING RADIO COMPASSES.

On April 1, 1920, all radio compass stations in operation in the United States will change their wavelength to 800 meters instead of the present 600 meters.

The final decision of the Director of Naval Communications is that all radio compass stations will listen in on 800 meters and transmit on 800 meters. This means that all control stations transmitting for radio compass stations will have their sets tuned to 800 meters. Radio compass stations will not get off the 800 meter wave except when directed by the control station (or the nearest shore station should the radio compass have an independent transmitter) to take bearings on a vessel which may be in distress.

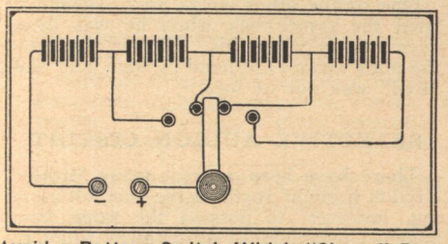
What Senate Leaders Say Concerning Radio Legislation

(*Continued from page* 541)

difficult subject to decide and cannot be considered in the same light as in 1912. He believes, however, now that Peace has come, we should adopt the ways of peace and do everything to encourage private enterprise, and therefore does not favor the passage of a joint resolution, which will have the effect of deterring private enterprises of engaging in the construction of efficient radio telegraph service. On the other hand Senator Fletcher believes that a resolution of the above nature does not go far enough to preserve the rights of the government to control radio station, and believes that the day has come when wireless communication should be controlled by the government. In fact the time may come, he says, when the government will be forced to shut out private stations on account of interference with government means of communication. The joint resolution was read twice and was finally referred to the Committee of Naval Affairs.

PRECAUTION AGAINST SHORTING BATTERIES.

When a rotary switch is employed to cut batteries into a circuit at the will of the operator care must be taken to space the contact points apart at such a distance that the blade of the switch does not touch both or any two points at any one time, otherwise this causes a direct short circuit between the cells in that particular circuit. This is clearly shown in the circuit below. Two contact points are selected with the

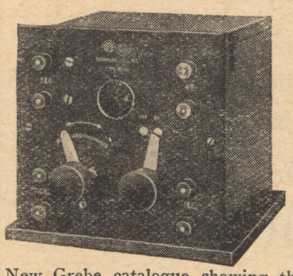


Avoid a Battery Switch Which "Shorts" Between Contacts.

switch arm touching both of them, showing how they shorted. By spacing the contact points correctly this trouble can be entirely eliminated. It is seldom practised, however, and it is the mission of this little note to forewarn you.

Contributed by
EDGAR TERRAINE JOHNSTONE.

AT LAST A RELIABLE AUDION CONTROL UNIT



Type RORH Grebe Audion Control Unit complete with two standard "VT" batteries, but less tube. Price $17.00. Same as above, less batteries and tube. Price $15.00. The Grebe latest Audion Control Cabinet type RORH contains the grid condenser, grid leak filament rheostat and two Standard V.T. plate batteries. The socket accommodates the usual 4 prong tube. Suitable binding posts for secondary, tickler, phones and filament battery are supplied which enables the user to use every type of circuit known without difficulty.

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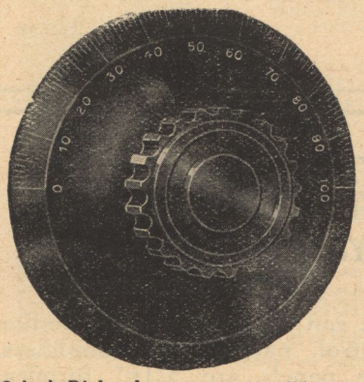

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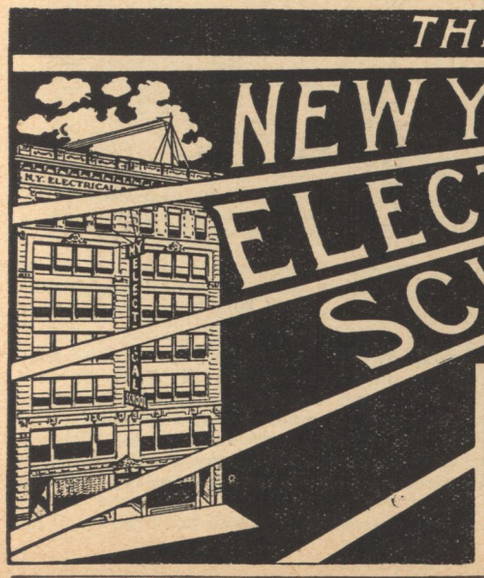

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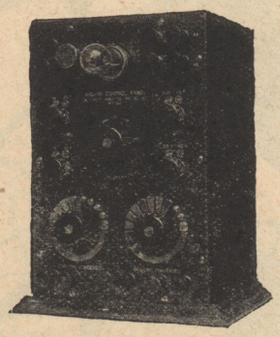

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We have special loose coupler parts, complete with specifications, slider type—$4.00.
DeForest's Variable Condensers—$5.25 up.
Amrad Quenched Gap—$17.50.
Catalog soon ready—send 10 cents for it.

READ THE CLASSIFIED ADVERTISEMENTS ON PAGES 596-598, YOU'LL FIND MANY GOOD THINGS THERE.

A Flying Tale Of Radio

(*Continued from page* 554)

throttle down and felt myself descending, and after a short time was on terra firma again. The pilot jumped out of his seat, listened to his engine and started a thoro investigation of the plane, after he had done his share of swearing—after the British fashion—the usual "Bloodys."

I became curious, got out, and went to see why we made the forced landing and what the trouble had been. He told me that he had heard a peculiar, squeaking noise and he thought that one of the bearings needed oil.

You can imagine his consternation and surprise when I told him that I knew what the trouble was and that I could produce the same noise without much trouble.

Our return trip was made in due time and we had a good report to turn in.

Well, when I got in the hangar I took pains to find out what made the peculiar squeak in the signals. And after a hard search found out that this Beacon Station used a motor much too small for its alternator which had a synchronised gap, so that every time the operator held down the key the motor slowed down under the load and the tone dropped to a much lower pitch.

I have heard that the pilot who was then a Lieutenant went back to get a better knowledge of Wireless for all he could do at that time was the regulation twelve words a minute and he had probably forgotten most of that. I think that the fellows had kidded him a lot and he realized that wireless was the thing for him.

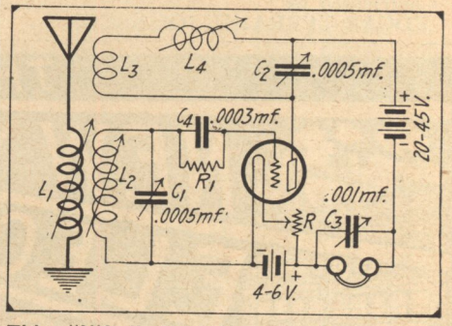
One of the other boys, "Red" Delahoyde tried the same trick when he was flying over a town where his "Flapper" lived but the pilot was an old hand by then, and poor "Red" was out of luck.

SELECTIVE AUDION CIRCUIT.

There have been a great many "tickler" circuits brought forth in the past, all seeming, however, to possess the same fruit, namely, instability of adjustment when receiving a distant station.

The circuit here presented is a combination of several well-known circuits, and has given me excellent results.

The diagram, being quite complete, needs but little explanation. L^1 and L^2 are the primary and secondary of an ordinary



This "Nifty" Hook-Up Has Been Found Very Effective.

coupler. L^3, the "tickler," consists of fifty to eighty turns of No. 28 B. & S. wire on a form 3½ to 5 inches in diameter arranged to slide over the secondary. L^2 is an ordinary tapt loading coil. R^1, the grid leak resistance, may be from one to three meg-ohms, according to type of tube used.

If desired, honeycomb coils may be substituted.

Contributed by STANLEY TERRY.

I Want to Know

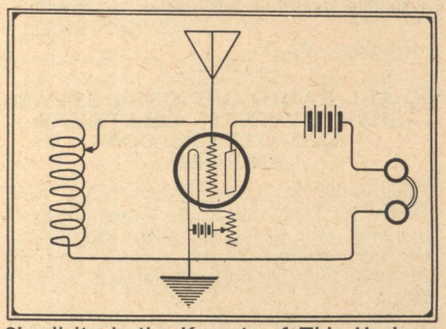
(*Continued from page* 566)

KV equals kilo-volts of transformer secondary.

N equals the frequency of the AC supply.

SIMPLICITY WINS OUT IN THIS RADIO CIRCUIT.

Loose couplers, variometers, etc., and what not enter into the amateur's daily life, making things rather complicated for him. While we can propound for hours the efficiency and inefficiency of both it is not the mission of this article to go into such a discussion. The object of the note is to bring to the amateur's attention the fact that a very simple circuit may be employed



Simplicity is the Keynote of This Hook-up.

for receiving which makes it very easy to hook up and extremely simple to manipulate. An ordinary single slide tuner is connected to an ordinary audion detector. The aerial to the grid of the audion and the ground connection brought to the filament. This makes it possible to tune up and down with but one adjustment; that of the slider.

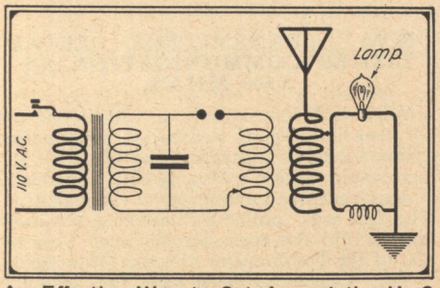
A single slider is the easiest of tuning instruments to build, therefore another advantage. The circuit is given herewith.

Contributed by E. T. JONES.

CHEAP BUT EFFICIENT RADIATION INDICATOR.

It is not generally known that a very efficient radiation indicating device may be constructed for little or nothing in respect to cost as compared to the steep prices of other similar devices sold on the market.

An ordinary flash-light lamp, a small socket, and three turns of No. 14 bare copper wire will do the stunt.



An Effective Way to Get Around the H. C. of Hot-wire Ammeters.

If the lamp is connected directly in series with the antenna it will burn out; however, by shunting the lamp with several turns of inductance (as it is termed) the lamp is protected and the current is divided between the two parallel circuits. It can be made to operate so that current flows thru the lamp in a greater proportion than thru the wire and *vice versa*. The whole apparatus comes to something like *twenty-five cents* as compared with the ordinary hot-wire ammeter selling at from seven to fifteen dollars. A connection of the instrument in the open radiating circuit is given.

Contributed by "OLD MAN IDEAS."

AMPLIFY YOUR RADIO SIGNALS

With the new DETECTAGRAPH-TRANSMITTER, the amateur can amplify radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument.

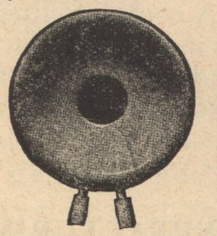
The super-sensitive DETECTAGRAPH-TRANSMITTER herewith shown is two and three-eighths inches in diameter, five-eighths of an inch thick and weighs less than three ounces. It is the most sensitive sound detecting device ever brought before the public.

The manner in which the amplifying process is attained is by attaching with tape the DETECTAGRAPH-TRANSMITTER to the regular wireless receiver.

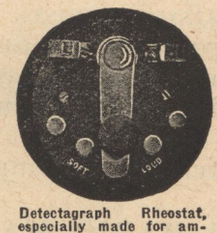
Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for magnifying other sounds. Phonograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter. It is the greatest device for building your own loud talking telephone, detectagraph and other devices. Can be used for any purpose where a sensitive detecting instrument is required.

SUPER-SENSITIVE Detectagraph MICROPHONE DEVICES

Our Super-Sensitive Detectagraph Transmitter. Price, $8.00 Complete

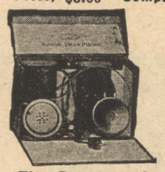


Our Special No. 25 Loud Talking Receiver. Price, $4.50 Complete



Detectagraph Rheostat, especially made for amplifying circuits. Price, $2.00 Complete

Super-Sensitive No. 40 Receivers to be used in connection with Detectagraph-Transmitters, $10.50



The Detectagraph Junior Deaf-Phone $18.00

Equal to any $35 instrument made. Outfit consists of Super-Sensitive Transmitter with cord connector; Super-Sensitive Ear Piece with small black cord; Black Single Headband; Black Case and Two Batteries.

Adjusted Model "B" Horn, with No. 20 High Grade Loud Talking Receiver, Cord Plugs and Desk Stand Base. Price, $12.00 Complete

Adjusted Model "C" Horn, with No. 20 High Grade Loud Talking Wall Receiver, Cord Plugs and Wall Base. Price, $12.00 Complete

Detectagraph $18.00

This detecting instrument of marvelous sensitivity can be used for detecting secret conversations. Outfit consists of Sensitive Transmitter, 25-ft. Black Cord, Receiver, Headband, Case and Battery.

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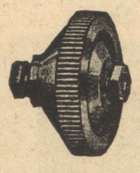

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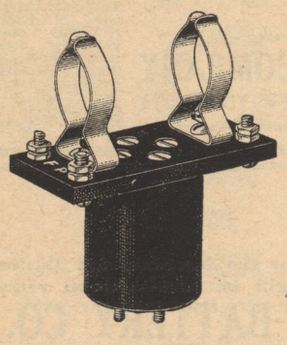

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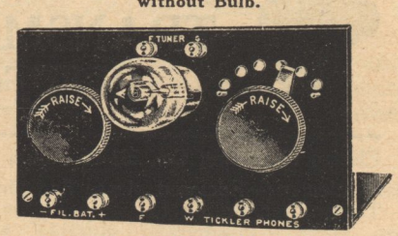


Best Polished XX Bakelite, lettered in white, a beauty. Use any American made bulb. Parts, ready to assemble, $8.50.

MONEY for YOU Add to your Salary—Make extra Pin Money Start a lucrative business of your own.
Spend an hour each day taking subscriptions for the "Radio Amateur News." We'll pay you well and you'll enjoy the work. Write for full particulars. Circulation Dept., RADIO AMATEUR NEWS, 233 Fulton St., N. Y. City.

With The Amateurs

(*Continued from page* 559)

best results I have another battery and a variable high voltage battery for each bulb. All connections are double "Litz" wire insulated by rubber tubing with soldered eyes and binding posts and any circuit can be made up in a few minutes. Four variable condensers do the necessary sharp tuning; one is the secondary condenser for tuning in a station, the condenser across phones and high voltage battery for adjusting the pitch and keeping out interfering stations.

A set of 3,200 phones is used for dampt wave reception, a Baldwin set for undampt waves. A Telefunken tuner was formerly employed but a Blitzen tuner was found to be nearly as good but easier to handle.

O. SCHUMANN.

Brooklyn, N. Y.

TO ALL RADIO OFFICERS, STEAMSHIP OWNERS, AMATEURS AND OTHERS CONCERNED.

Beginning 8 P. M. sharp, NAA time, March 26, 1920, the Radio Communication Company will broadcast news supplied by the International News Service and the Universal Service on a wavelength of 2,100 meters.

This news must not be copied, publisht, sold or used in any manner unless it is distinctly stated on every copy or bulletin that the news matter is furnished thru the Radio Communication Company's wireless stations and supplied by the International News Service or the Universal Service.

The procedure will be as follows: At 8 P. M. sharp, daily, NAA time, WHB will transmit general call and then call ships for which it has traffic on file. Immediately after calling ships, transmission of press will start. After the transmission of press has ceased, ships will again be called and messages broadcasted. Ships receiving these messages should O. K. to WSK immediately, when they come within range or the O. K. may be given to WHB between 6 P. M. and midnight.

It is requested that operators copying this press service make a report to this company, stating the distance at which it was received and any criticisms they have to offer of this service in any way.

CYRIL D. REINHARD,
General Superintendent.

2-K.W. TRANSMITTER ESTABLISHES COMMUNICATION AT 5,600 MILES.

What is believed to be a world's record for transmission of a wireless message by a low-powered apparatus was made by the navy radio station at Ingelwood, California, it was recently announced at Washington. The feat was "pulled off" between the navy station and the trans-Pacific liner Venezuela, of the Pacific Mail Steamship Company.

The Venezuela, with only two kilowatt apparatus, communicated for some time with the Ingelwood station. At the time the vessel was about seventy miles outside the port of Yokohama, Japan, and flashed and received several messages from the Ingelwood wireless, a distance of 5,600 miles.

What do you think of this achievement, radio men; is it not prophetic of some wonderful distances yet to be covered. In a very short time, the radio amateur, himself, will be communicating from the United States to foreign countries direct. Better "dig up" your French, Spanish, Italian, German and Swedish dictionaries—yes, and your Chinese and Japanese vocabularies, too!

Dictionary of Technical Terms Used in Radio

(*Continued from page* 563)

current to the machine when running.

Brush Holder—Metal clamp capable of adjustment which holds the brush in position on the commutator of a dynamo or motor.

B.S.G.—British Standard Gauge of Wire.

Buckling of Plates—During discharge of a Secondary Cell the plates gradually expand, owing to the fact that lead sulphate has about twice the volume as the same quantity of lead peroxide. Should this expansion or discharge take place too quickly, the plates will bend or buckle.

Bunsen Burner—An alcohol flame burner designed to furnish a maximum heat upon applied objects such as metals and glass.

Bunsen Cell—A cheaper form of Grove cell having platinum foil replaced by carbon rod. In resistance and Voltage practically same as Grove. See Grove Cell.

Bus Bar—A single bar which serves as a common connector for a large number of pieces of apparatus. Also called Omnibus Bar.

Bushing—A piece of composition or fiber used for the purpose of separating electrical circuits in any given piece of apparatus.

Buzzer—Same as electric bell, but with hammer and gong removed. Used for testing receiver gear by means of a small local circuit. Make-and-break contact is made to serve as a small spark gap, the small spark thus formed setting up oscillations which are plainly recorded by the detector. Sometimes shunted across and exciting the closed circuit.

Buzzer Practice Set—A combination of a buzzer and a signalling key arranged on a common baseboard used for the purpose of practising Morse signalling.

B.W.G.—Birmingham Wire Gauge.

Carbon—C. A. W. 11.91.

Carborundum—A potential crystal rectifier. An artificial silicate of carbon (SiC) produced in an electric furnace. Has various tints from deep grey to violet purple. *Is next in hardness to diamond.* Silver-grey kind is most sensitive for detector use. Used in contact with steel.

Cartridge Fuse—One in which the fuse wire is surrounded by some non-inflammable substance, enclosed in a cartridge-like cardboard tube and having brass lugs soldered to caps at ends. Used to prevent the hot wire from "flying" when fused.

Cascade—Term applied to a number of Leyden Jars or other condensers connected up to series.

Cascade Amplification—Where amplification of received radio signals is accomplisht by employing several Vacuum Tubes in cascade fashion.

Cascade Converter—Continental and American term for the motor convertor.

Cathode—See Electrolysis.

Cation—See Electrolysis.

Cat Whisker—So-called on account of its appearance. Usually a fine spring wire resting lightly on any mineral or crystal of a detector.

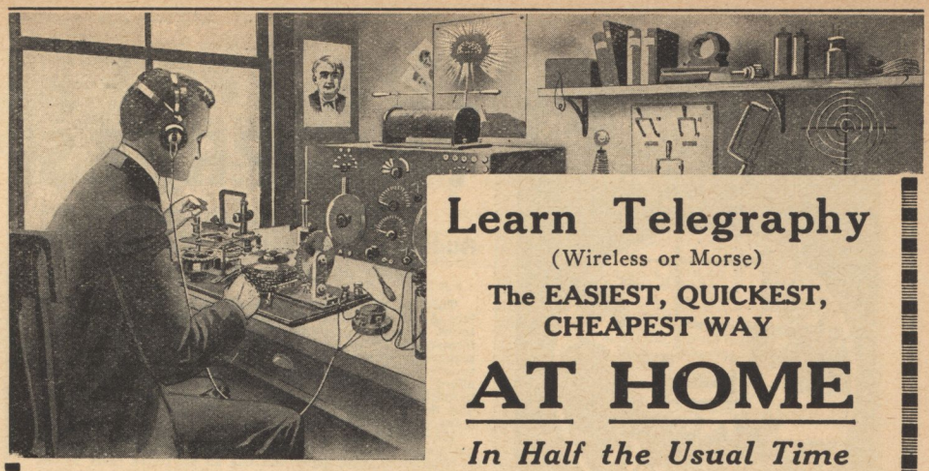
Caoutchouc—See India rubber. (French tern.)

Cell—Apparatus producing an electrical current by chemical action. See Simple Cell.

Cells Multiple Arc—Two or more rows of cells in series but with like poles of terminal cells connected together.

Cells Parallel—All negative poles together and all positive poles together.

Cells Series—Negative pole of each cell is



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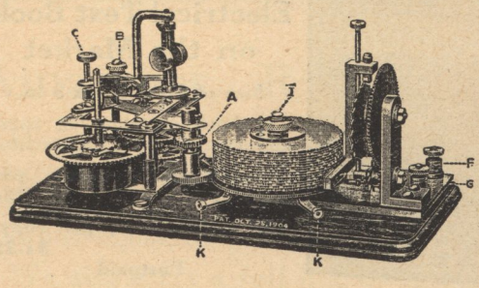
The Omnigraph is an *Automatic* Transmitter that teaches you both the Wireless and Morse Codes, at home, without any expense except the cost of the machine itself. Merely connect to battery and your Buzzer, or Buzzer and Head Phones, and the Omnigraph will send unlimited messages by the hour, *at any speed* you desire.



USED BY THE U. S. GOVERNMENT

The Omnigraph is used by the Government in testing all applicants applying for a Radio License. It is also used extensively by the large Universities, Colleges and Telegraph Schools throughout the Country for teaching Wireless and Morse. Hundreds of the Army's skilled operators who served during the war learned with the Omnigraph.

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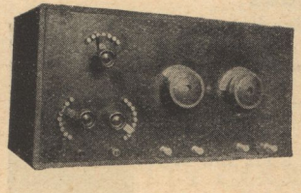

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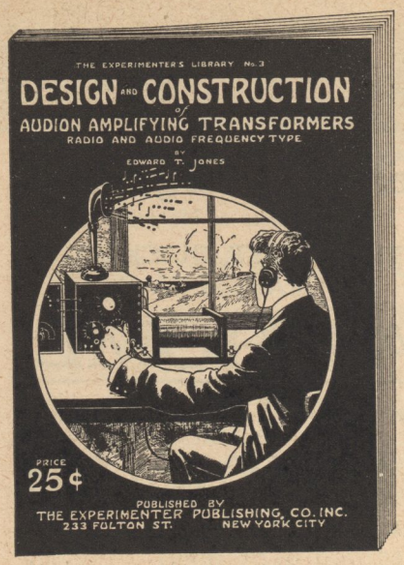

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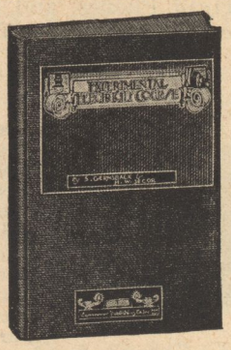

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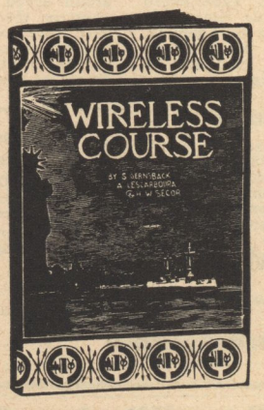

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connected to positive pole of the one following.

Centigrade—Freezing point is 0°, boiling point is 100°.

Centigrade to Fahrenheit—(Nine-fifths of C reading) plus 32.

Centrifugal Force—May best be understood by considering a stone when thrown from a sling. The stone travels in the direction which the sling was moving at the precise moment that it was thrown off. The apparent tendency of a body to "flyout" when being rotated is due to fact that in a rotation it is being subjected to a force which is constantly changing its point of application, but owing to inertia the body does not so readily respond and change its direction of motion. The force which holds the body in check is termed Centripetal Force, which literally translated means "center seeking."

Centripetal Force—See Centrifugal Force.

Cerusite—Whitish grey lead ore. $PbCO_3$. Used as a rectifier.

Cesium—Cs. A. W. 132.

C. G. S.—Metric units. Centimeter Gramme-Second.

Chalcoprites—See Copper Pyrites. (Cu_2S. Fe_2S_3).

Characteristic—Of a log it is the whole number, i. e., number to left of decimal point. See Index.

Characteristic Curve—One showing relationship between voltage imposed on a conductor and the current flowing thru it.

Charge—A quantity of Electricity at rest.

Charging Accumulators—The forming and reforming of the plates or the changing of their chemical composition by passing a current thru them until the compositions necessary to form a primary cell are produced. See Secondary Cell.

Chemical Compound—Two or more elements combined by chemical action. Compare Mechanical Compound.

Chemical Equivalent of an element, is the mass of it which is chemically equivalent to a unit mass of Hydrogen. Is obtained by dividing A. W. by Valency, Val.

Chlorine, Cl.—Non-inflammable, greenish yellow gas. Suffocating smell. A. W. 35.18, S. G. 1.33.

Chloride Accumulator—A secondary Cell in which the positive plate is formed by a sheet of antimonial lead containing a number of holes in which are forced spirals of pure lead. Initial S. G. of acid is 1,215.

Choke Coils—Coils wound to have great Self-Induction. Usually wound over an iron core, which is generally composed of a bundle of wires, "Tails" or laminated sheets insulated from each other to prevent Eddy Currents. The choking effect is called Impedande. See also Aire-Core Choke, and Inductance Coil.

Chromic Acid Cell—Same as Bichromate Cell, but has fluid of chromic acid and sulphuric acid in place of bichromate of potash. Low internal resistance. E.M.F. 2 volts.

Cipher—Commercially, groups of five letters or figures having a secret meaning. Compare Code. Some Government ciphers have more than five letters per group.

Circuit, Closed, Oscillating—The path in which an electric current flows is called a circuit. It may consist partly of a metallic conductor and partly of the dielectric of a condenser. If this condenser has its plates very near together so that the lines of electrostatic force are mostly contained between the two plates, the circuit is called a closed oscillating circuit.

Circuit, Open or Radiating—A circuit comprising in part a metallic conductor and in part a condenser, the plates or surfaces of which are very far apart, so that the

lines of electrostatic force extending from one plate to the other stretch far out into the surrounding space.

Circular Mil.—Area of a circle having a diameter of one mil F. P. S.

Clark Cell—Formerly the Standard Cell, but now replaced by the Weston Cell. Container is a glass tube. At the bottom is mercury, the H. P. element then a paste of mercurous sulphate and saturated zinc sulphate, above which is a quantity of saturated zinc sulphate. A zinc rod is held in position with its base in the zinc sulphate paste but not in contact with the mercury. A platinum wire, insulated by a small glass tube, makes contact with the mercury and forms positive pole. E.M.F. 1.43 Volts at 15 degrees Centigrade.

Cleats—Porcelain wall fasteners for wires, consisting of a base having two grooves

Clips—Small mechanical spring devices to receive the wires, and a covering piece. The whole being held in place by a single screw through the middle.

used to make contact or connection with any circuit.

Close Coupling—Exists where primary and secondary of jigger or oscillation transformer are very close together, when Inductively coupled; or if Direct coupled, when a large proportion of the turns are common. Causes much Mutual Inductance.

Co.—Contraction for word Complement.

Coatings—Tinfoil of Leyden Jar, or metallic plates of any condenser.

Cobalt Co.—Hard grey ductile Met. El. A.W. 58.56. S.G. 9.0. Slightly magnetic.

Code—Real words, not forming comprehensible sentences, or pronounceable artificial words. Compare with Cipher.

Coefficient—A number by which the value of a quantity must be multiplied to give numerical value of another quantity.

Coefficient of Coupling—Ratio between the Mutual Inductance and the square root of the product of the individual inductances.

Coercive Force—Magnetic force necessary to remove all Residual Magnetism. See also Retentivity.

Coherer—A Detector based on the imperfect contact of certain points in a circuit becoming almost perfect in presence of Electro-magnetic Waves, thus permitting a current to pass from a local battery owing to a decreased resistance. See Marconi, Branly, and Lodge.

Coil Contacts Sticking—See Sparking at Coil Contacts.

Collets—Small porcelain tubes having a collar at one end and held in position by a screw passing thru the center of tube. Used for laying Twin Wires.

Commutator—A two-way switch used for changing the direction of a current in a circuit. On a dynamo or motor, refers to the number of copper strips fixt on a cylinder of insulator and parallel to the axis of armature shaft, to which are affixt the ends of armature windings. Produces a direct current from the alternating current which all dynamos naturally generate.

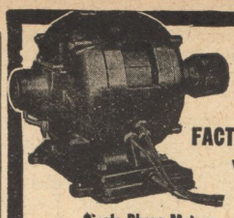
Compass, Radio—A name given to a form of radio telegraphic direction finder by which the bearings of a transmitting station can be ascertained by the receiving station.

Complement of Angle—Amount necessary to be added to produce a right angle.

Complement of Arc—Amount necessary to be added to an arc to produce a right angle, that is, ninety degrees of a circle.

Compound—A combination of two or more elements. See Chemical Compound, and Mechanical Compound.

Compound Magnet—A number of magets used as one, having like poles adjacent. A Laminated Magnet, Magnetic Battery.



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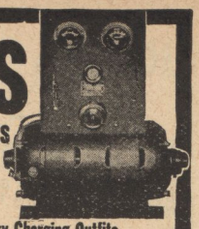

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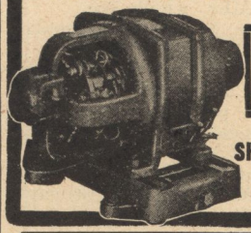

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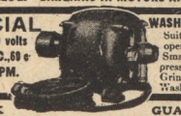

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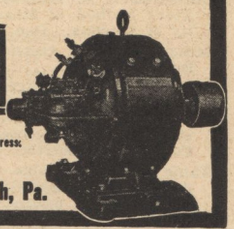

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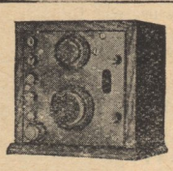

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Condensers in Series—Decrease total capacity.

Conductance—Property of a body for conducting electricity. Unit is Mho, which is the reciprocal of the Ohm.

Conductor—A material through which electricity passes freely. All metals are so styled.

Conductively Coupled—See Direct Coupled.

Conductivity—Unit Mho, which see.

Cone Insulators—See Strain Rod Insulators.

Consequent Poles—Poles occasionally produced in a magnet during magnetisation, other than the true poles, "End" poles.

Co-ordinates—Abscissae and Ordinates taken together.

Contact Breaker—An automatic switch for rapidly opening and closing the primary circuit of an induction coil, bell, etc. See also Hammer break.

Contact Rectifier—The name given to the contact between two substances which has the property of conducting electricity better in one direction than the other. Thus a contact rectifier can be made by a contact between galena and plumbago.

Continuous Current—Direct Current, D.C. One flowing constantly and regularly in one direction.

Continuous Waves—C. W. A. wave train whose amplitudes are constant. One having no damping. In practice is produced by an arc discharge in place of spark, also by an oscillating Valve. H.F. Alternator, or Reflection Alternator (Goldschmidt), also by frequency multiplying transformers as in Telefunken, and also by the Marconi "Timed Spark" discharges.

Convective Discharge—A continuous discharge from high frequency or high potential apparatus.

Convertor—A machine similar in construction to a motor, but being supplied with slip rings in addition to commutator. Used to convert D.C. into A.C. or vice versa. See also Motor Convertor and Rotary Convertor.

Copper—Cur. Cuprum. Metallic Element. A.W. 63.1 S.G. 8.9. Val. 2. Chem. Eq. 31.5. El. Chem. Ew. 0.000,328,1 S.R. Annealed 1.561 S.R. Hard drawn wire 1.621.

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Copper Sulphate—(CuS04. 5H20). A salt of copper. Also known as Blue Stone and Blue Vitrol.

Core—The iron center of an electromagnet. Center strand of multi-strand wire.

Core Disc—Toothed disc stampings of thin sheet iron which compose the laminated core of an armature.

Core Type—Transformer having the majority of its core inside both coils.

Corkscrew Rule—See Maxwell.

Corona—Brush discharge effect surrounding a condenser or other apparatus actuated by high potentials. See Brush Discharge.

Cosec—See Cosecant.

Cosecant—Secant of complement of an arc.

Cos—See Cosine.

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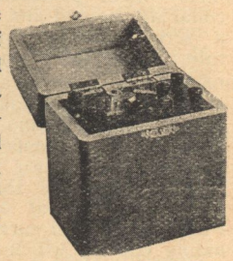
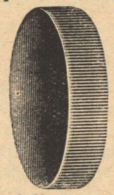
235 Fulton Street New York City

Going Away This Summer? Take This Special Receiving Set

A piece of wire with a piece of copper at one end for ground and a pair of receivers—that's all you need to add to this set to receive any message sending up to 800 meters.



This Special Set $6.00



SPECIAL COUPLER PARTS, Complete — $4.00

SPECIAL Crystal Detector 75c

Knob 20c

Dials, 3 and 4-inch diameter, 75c. Knob attached, $1.25. Cyclone Batteries, small, $1.15; large, $2.10.

Extra postage for mailing

ALL PARTS FOR THE AMATEUR

Actual Size 20c per Doz.

Cosine—Sine of complement of an arc.

Cosine Curve—See Sine Curve.

Cot—See Co-tangent.

Cotangent—Tangent of the complement of an arc.

Couple—See Torque.

Coupling Waves—The two waves produced when oscillating circuits are coupled.

Coulomb—Unit of quantity of electricity. That quantity which flows in one second through a conductor carrying a current of one Ampere. 3,600 Coulombs equal one Ampere-Hour.

Counter E.M.F.—See Back E.M.F.

Coupling—A measure of the Mutual Inductance between two oscillatory circuits. The connecting of two oscillatory circuits. See Direct, Inductive, Loose Percentage, Tight, etc.

Coupling, Coefficient of—This is generally expressed as a percentage and denotes the ratio of the mutual inductance of two circuits to the square root of the product of their separate self-inductances. The coupling is thus spoken of as a 5 or 10 per cent coupling or more. It is generally called weak when less than 5 per cent, and strong or closed when more than 10 per cent.

Coversin—See Coversed Sine.

Coversed Sine—Versed sine of complement of an arc.

Crystals—See Bornite, Carborundum, Copper Pyrites, Galena, Graphic Tellurium, Iron Pyrites, Nagyagite, Perikon, Rariocite, Silicon, Sylvanite, Tellurium, and Zincite.

Crystal Detector—One depending upon fact that certain combinations of metallic crystals and metals permit a current to pass more readily in one direction than the other, thus having a rectifying effect upon a train of oscillations, converting it into an intermittent direct current which may be made to work a sensitive telephone. Crystals may be cleaned with Carbon Disulphide. See Crystals.

Cs.—Cesium.

Cur.—Cuprum. See Copper.

Current—Rate of flow of Electricity, the unit of which is the ampere. See Ampere.

Current in a Circuit—In Amperes equals pressure in Volts divided by resistance in Ohms; or, C equals E over R.

Curve Drawing or Plotting—A graphical method of showing relationship between different dimensions, or path of a movement.

Cut-out—Any arrangement by which an electric circuit automatically opens itself if the current exceeds a certain value. The most ordinary form of cut-outs is a fusible wire, but for larger currents a magnetic cut-out is employed in which an electro-magnet traversed by the current opens a switch when the current exceeds a certain fixt value.

Cycle—To revolve in a circle. A series of events which occur in the same regular order.

Cyclic—Pertaining to or contained in a cycle.

Cymometer—Fleming wave-meter. Has the variable inductance and capacity operated by one handle.

Cymoscope—A wave "Seer."

Cypher—See Cipher.

Attention Beginners!

Before going into practical instruction it is important that the boys who are to become the radio men of the future should appreciate the value of such work. Radio transmission of messages and of the human voice is becoming daily more common. Prepare yourself in the proper manner by carefully reading the Junior section of RADIO AMATEUR NEWS.

RADIO EXPERIMENTERS ATTENTION

Over 1,500 other radio experimenters are saving large amounts on their purchases of radio and electrical equipment. They are purchasing through this association almost everything advertised in this magazine. They are saving money on everything they buy, whether it is raw material or the finished instrument.

$7.00 telephone receivers are purchased at 10% saving
$18.00 loud speaking telephones net them $1.50 saving
$7.00 VT Tubes are being purchased at a 50c saving
$4.50 Amplifier transformers at a 25c saving
$17.00 Audion control cabinets net them $1.75 saving

You also can make these savings, which bring you the goods of almost every manufacturing advertised in this magazine at a saving of from 5 to 20 per cent. on the prices advertised. Write for details immediately. We can save you money on anything electrical which you intend to buy. By buying through the association you are assured that your order will be filled the day it arrives.

SPECIAL OFFER

Members can obtain a limited number of 4-Volt 60 Ampere Marko storage batteries for $7.00 net. A limited number of "B" batteries offered at a saving of 25c on advertised price $1.25 (22 Volt. fixed).

MUTUAL PURCHASING ASSOCIATION

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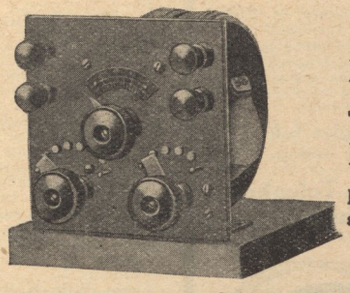
AT LAST!! RIGHT PRICES!!

"B" Batteries IMMEDIATE SHIPMENT

22½ volts, Life 1500 Hours. Sizes: 2¾ x 3½ x 4½". Postpaid $2.00
45 volts, Life 1500 Hours. Sizes: 3½ x 4¾ x 5¾". Postpaid $4.20

UNIVERSAL RADIO VARIOMETER

Price Lists on Request



Type "S-1" 1000 Meters — $12.50

Type "S-2" 2500 Meters — $12.50

In ordering please specify winding. Size 6 x 6 x 6 inches.

THE RADIO APPARATUS SERVICE
711-THIRTEENTH STREET, WASHINGTON, D.C.
"A SUPPLY COMPANY FOR THE RADIO AMATEUR"

Radio Call 3 E K Phone Main 2833

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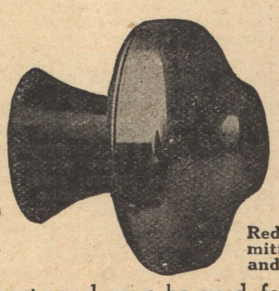


Reduced Photograph of Transmitter showing nickel plated case and Hard Rubber Mouthpiece

$1.00 ONLY

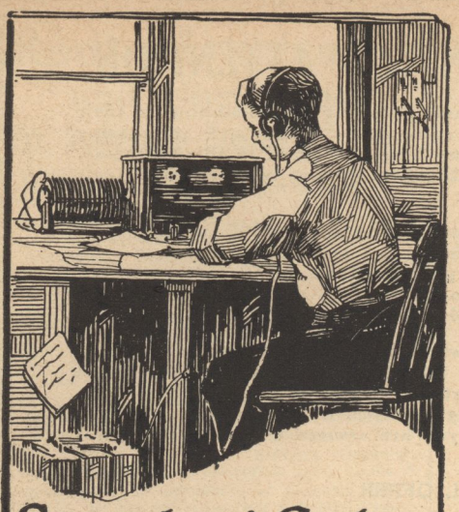
Postage extra.

Ship. Weight, 2 lbs.

Diameter, 3¼ ins.

We have on hand 2,000 Carbon Grain Transmitters as per photograph. They are first-class instruments and may be used for all kind of experiments, especially for wireless telephone sets, where a heavy current is to be passed through. Slightly used, but in perfect working order. Money refunded if not satisfied. A real bargain. Order one or more today.

THE ELECTRO IMPORTING CO., 231 Fulton St., NEW YORK



Stromberg-Carlson Radio Head Sets

STRONG, DURABLE CONSTRUCTION, YET EXTREMELY SENSITIVE.

This Stromberg-Carlson Radio Head Set is very simple and efficient. All operating parts are housed in dust-proof moisture-proof aluminum case. The diaphragm is mounted metal-to-metal in a way that the variation in temperatures cannot disturb the airgap adjustments. Non-conducting spool heads and slotted pole tips decrease the eddy current losses and make the set more efficient.

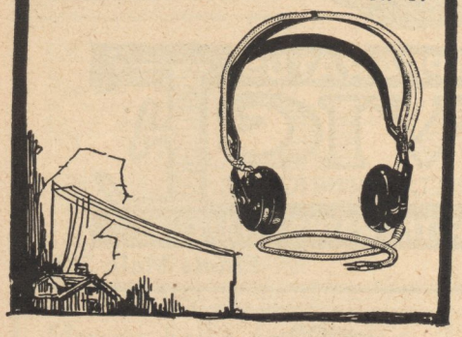
Each set wound to a resistance of 2,000 ohms with pure copper wire, furnished complete with 6-foot moisture-proof cord attached.

All sets thoroughly tested in actual service before shipment. For $12.00 we will ship sample set for trial in your own station. If not satisfied—return equipment and money will be refunded.

Bulletin 1206 will give full particulars. Write today.

Stromberg-Carlson Telephone Mfg. Company

Rochester, N. Y.



Club Gossip

(*Continued from page* 556)

July 1, 1919, has sixty members and more coming. This association is doing good work. All of the members who have transmitting sets have them sharply tuned by oscillation transformers. This has been the means of increasing the range and cutting down on the QRM. Many of these sets equipt with one-inch coils are sending twenty miles.

The association has members who served during the war with the armies of allied nations and when they returned brought back with them radio information of the latest order, and this has been a great help to the other members.

Ninety per cent of the members are using vacuum tube equipment and excellent short wave work is being done.

We are 100% licensed amateurs. We should like to hear from other Radio Associations, and any of those within traveling radius; would be pleased to have them send a representative to tell us what they are doing.

Address communications to Raymond S. Jackson, secretary.

Convention Broadcast of the Philadelphia Amateur Association.

Amateurs, Third District, you are invited to attend a convention and banquet to be held under the auspices of the Philadelphia Amateur Radio Association in Philadelphia. This is the final event of the '19-'20 season and it's a long, long time till the next.

This convention is intended to strengthen the bonds between the amateurs of this part of the country and give them a good time while they are meeting the men that handle the 3 sets. Come out and listen the officials of the A. R. R. L., help arrange a program for summer and fall and meet the men you have talked to over the ether. There will be good talkers, plenty of good eats, smokes, music and a rip roaring good time for all who attend. It's on a Saturday night, you know, stay over and see the town; it's called slow, but don't you believe it.

Tickets are $2.00; the big show is called for 7 P.M. at Twelfth and Girard Avenue, Philadelphia, Saturday, May 8. You club secretaries, write and tell us how many members you can send and we will fix up a nice little table up front. Let's hear from you 3's; address W. G. Wunder, 3220 Stillman Street, Philadelphia, Pa.

The Radio Club of Evansville, Ind.

The Radio Club of Evansville, Indiana, has about 20 members and meetings are held weekly, one week at the Y. M. C. A. and the next at the homes of the members who have radio sets. The club is divided into three classes of members, the first class containing those who have government licenses, the second contains those who have receiving sets and can receive five words per minute, and the third class those who have just become interested in radio. At each meeting twenty minutes is spent in practising the code. Once every four weeks a talk on Radio Telegraphy or Telephony is given by one of the members. At a meeting some time ago the club was honored by the presence of Lieut. Rodd, radio officer of the famous NC-4. He complimented one of the members, William Russell, on the efficiency of his set. The club has decided to secure a membership pin somewhat like the Radio League of America's. The pin will be of silver with blue enamel fillings. The officers of the club are: Russell Schoene, president; Samuel Weil, vice-president, and Jack Gnas, secretary-treasurer. The entrance fees of the club are 50 cents and the dues 20 cents a month. The club has a room on top of the Y. M. C. A. which will be used for a radio laboratory. The club is now conducting a set. The aerial will be over 100 feet high and about 125 feet long. Any club wishing to correspond with this club should write to Jack C. Gnas, 1901 East Louisiana Street, Evansville, Ind.

Radio Expert Lectures to Amateurs.

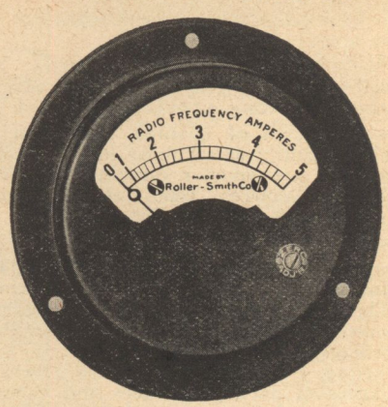
Capt. E. R. Crum, signal corps, U. S. A., recently gave a lecture and discussion at Community Center, 613 Market street, on radio telegraphy. He invited the special attendance of young men who have radio outfits and radio telegraphy clubs formed.

Bedford Wireless Association.

The first meeting of the Bedford Wireless Association was held in the radio room of the Bedford Y. M. C. A. The officers elected were: G. Johnson, president; J. Corcoran, secretary, and Brown, treasurer. we have secured two instructors, Dr. Happe, an all-around radio man, and Mr. Bowie, formerly radio instructor in U. S. Navy Radio School at Harvard University, who will give us instructions every Friday night, 8 to 10 o'clock. We are also arranging to visit the big navy radio and the wireless stations of the different newspapers and see their apparatus.

We have a well equipt radio room which consists of a receiving set, 15,000 meters, and a sending set of a motor generator, ½ K.W. transformer, 5 Murdock condensers, a rotary gap and an oscillation transformer. All those in the Bedford District who are interested in wireless and who would like to join, see or write to Mr. James Corcoran, secretary, 420 Gates Avenue, Brooklyn, N. Y.

"BRAND NEW"



Introducing the Roller-Smith "Type T-a-w" Radio Ammeter

If you have a radio station you need an ammeter. If you need an ammeter at all you need a **good** one—and we have just what you need.

It's especially designed for your requirements — it's rugged and reliable, and can be used equally well on **radio frequency, audio frequency** and **direct current.**

Send for our "T-A-W" Catalog

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Electrical Instruments, Meters and Circuit Breakers

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Works: Bethlehem, Pa.

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Radio Intelligence Bureau

Earn $125 to $150 per Month

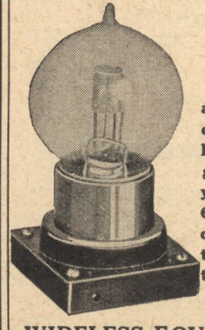
Complete Course and Practice Buzzer Set $15 Prepaid

Course prepared by a leading authority on the subject. All questions answered free after purchase of course. The entire faculty is at your command to solve your problems.

We Design Wireless Receiving sets; Wireless Transmitting sets; Wireless Telephone sets; Underground "Rogers" installations, complete or individual instruments, at nominal cost. Build your own apparatus at one-tenth the cost. We furnish dimensions, drawings, and diagrams complete. Special Questions answered by our Query Department at 25c each. If questions involve considerable research work, etc., a special charge, not to exceed $5.00, is made.

RADIO INTELLIGENCE BUREAU
864 Roosevelt Pl., Dept. A, New Orleans, La.

A New
VACUUM RECTIFIER TUBE
for
Wireless
Telephone



absolutely the newest device on the market. Does away with motor generator. It permits you to use 110 VOLTS, 60 CYCLES alternating current and rectifies this to direct current for the transmitting tube.

Get our free descriptive circular 13 B.

WIRELESS EQUIPMENT CO., Inc.
19 Park Place New York, N. Y.

The Ravenswood Radio Association, Chicago.

In every radio amateur will be found the desire to meet and get together with the other amateurs in the locality, which meetings invariably tend to bring about a more or less personal relationship with each other. This personal touch and good-fellowship among the amateurs is a thing which is of vital importance to the systematic handling of radio traffic and the reduction of local interference.

Organization among the amateurs has proven to be a success with manifold benefits derived therefrom, proof of which can be found in the Ravenswood Radio Association of Chicago.

This organization was founded a little over a year ago by a few commercial licensed Chicago amateurs and these founders, having seen all previous radio clubs in this city go to pieces because of improper methods of organizing, decided it was time to start a really stable association. To this end applications for membership were restricted to commercial licensed amateurs only, and in this way a membership of experienced, intelligent and capable men was establisht. The senior division of this association now consists of twenty-two commercial licensed amateurs, which comprises about ninety per cent of the active commercial licensed men in this city.

About one month ago it decided that the membership had reached the saturation point of this class of amateur and, believing that the other amateurs of lesser experience would welcome a chance to connect with such a club, a junior membership was establisht.

Very noteworthy radio work is being done by many of the members, such as 9AR, 9AU, 9BG, 9ZN and many others. The vast experiences of the various members would make a story in itself, but space does not at this time permit its publication.

Discussions and lectures are given at the weekly meetings and this association has without a doubt become the most stable and foremost amateur club that Chicago has ever known. A membership certificate has been recently issued which they can be justly proud of.

Any further particulars may be obtained from the Secretary, Mr. N. E. Wunderlich, addressed at the Executive Headquarters, 4533 North Sawyer Avenue, Chicago, Illinois.

Junior Radio Course

(*Continued from page* 563)

of energy has been taken away; that is the violent blow, the swinging motion gradually decays and finally the pendulum will come to a complete rest. In the 3rd diagram, which is that of the highly dampt oscillations, the pendulum has been given a slight blow to start it going, but owing to the fact that the pendulum is shorter in length and does not have as much weight at its end as in the two previous cases, it will only oscillate back and forth a few times, then quickly come to a rest. These three illustrations may be said to represent the same action which takes place in the three forms of oscillations which are spoken of in radio telegraphy.

In the next lesson we will describe in a simple manner the best kind of spark transmitters for the amateur to use where the decrement is as low as possible, so that even a ten-year-old school boy will understand it.

QUESTIONS FOR THIS LESSON

1. Have undampt oscillations any decrement?
2. What systems produce dampt and undampt oscillations or waves?
3. What kind of oscillations does the United States government forbid?
4. How many complete oscillations should an ideal wave train have?
5. What is meant by a train of oscillations?

K. OF C. SENDS RADIO ACROSS COUNTRY.

A Radiogram was recently received by the radio school of the K. of C. in New York City from the San Francisco branch of that organization. The message was relayed by amateurs in various sections of the country.

Thousands of Electrical experts are needed now. Come to the great shops of Coyne and let us train you quickly by our sure practical way backed by 20 years of success.

Earn $125 to $300 a Month

Come to Coyne where experts train you on the actual apparatus. You work on everything from the simple bell to the mighty Generators, Electrical Locomotives and Power Plants. Everything to make you a Master Electrician. Look at the picture taken from life in our shops.

Become an Expert in 3½ Months

No need of taking 1 to 4 years to become an expert. We have proved this in thousands of cases. We are the only school teaching by the original Coyne methods, which means no books, no classes—all practical training.

Earn Your Way. Our employment department will help every ambitious man to earn a part or all his expenses—without charge.

Bennett W. Cooke, Director
COYNE TRADE AND ENGINEERING SCHOOLS
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CHICAGO, ILL.

LEARN DRAFTING

The country needs hundreds of skilled Draftsmen in all lines at big salaries.

Coyne is the only school in the country that gives you the advantages of big shops full of construction and machinery. This makes our drafting courses practical, just like the job you'll have when you graduate. You can't get this in any other school.

WE TEACH ELECTRICITY, DRAFTING, MOTION PICTURE OPERATING AND PLUMBING

We teach all these professions in such a thorough, practical way that when you finish you can step right into a position of responsibility and big pay. Fill out the coupon *now* and send it for our big free book of information. It tells what others are doing and have done, what you can do.

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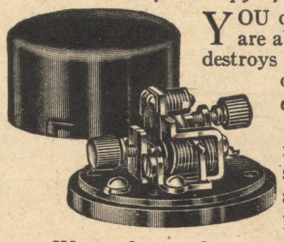
Get a copy of our complete wireless catalog and order all of your radio material from one source of supply and save trouble.

Send 25c for a copy of Wireless Manual and Catalog M12—Ready May 10



YOU cannot get satisfaction from wireless instruments unless they are absolutely perfect. The slightest imperfection in construction destroys their efficiency. We offer for sale wireless apparatus only of the highest quality, guaranteed to be mechanically and electrically perfect.

Our combined Manual and Catalog illustrates and accurately describes the uses of standard radio instruments and should be of great assistance, not only to the amateur but also to the professional user and experimenter in selecting proper radio material.

We make a charge of 25c for this Manual, issuing a coupon redeemable on an order for $5.00 or more.

It is the last word in wireless catalogs. Send for a copy now. You cannot afford to be without one when you want to buy.

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Objectionable or misleading advertisements not accepted. Advertisements for the June issue must reach us not later than May 10.

THE CIRCULATION OF RADIO AMATEUR NEWS IS OVER 35,000

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Railway Traffic Inspectors: Splendid pay and expenses; Travel if desired: Unlimited advancement. No age limit. Three months home study. Situation arranged. Prepare for permanent position. Write for booklet CM-122. Standard Business Training Institute, Buffalo, N. Y.

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Young men to sell our card specialties. Easiest selling novelties in the world. Outfit free. John W. Burt, Coshocton, Ohio.

Sales Letters that sell your goods, $3.00. Fresh mail order names, 20c hundred. Circulars mailed, 20c hundred. Advertise in "The Quaker," 25c year. Classified, 2c word. T. Nelson, 1210 South Broad, Philadelphia, Pa.

Patents for Sale. To sell, buy or obtain patents write Patent News—309, Washington, D. C.

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Blueprints:—Learn Blueprint Reading:—from 33 large Blueprints—It matters not what line you are in,—We show you how—An easy home study—It's job insurance—Get our circular—or send $1 for the first four Blueprints—if satisfactory, order balance later. Chas. J. H. Freeth, Consulting Chief Draftsman, Mechanics' Improvement Association, Dept. 25, 1628 Lehigh Ave., Phila., Pa.

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Concordia Magazine contains essays, short stories, travel stories, boy scout news, editorials, current events and poetry, formulas and plans. Two years' subscription 50 cents. Concordia Magazine, 9 Water, York, Pa.

Star Amateur Electrician. Pocket size, 12c. Joel Tillberg, Proctor, Vermont.

Nature Laws married and engaged people should know, 50c. Central Company, 601 Ninth Avenue, New York. Book lists free .

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Experimental Electricity Course in 20 Lessons. By S. Gernsback and H. W. Secor, E. E. A course in the theory and practice of Electricity for the Experimenter. Every phase of experimental electricity is treated comprehensively in plain English. New experiments are described and explained and nearly every application of Electricity in modern life is given. 160 pages—400 illustrations. Flexible cloth cover, 75c postpaid. Stiff cloth cover $1.25 postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton Street, New York.

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Exchange.

500 cycle 400 watt self excited generator, transformer, quenched spark gap in compression rack, field rheostat, oscillation transformer $150.00. 250 watt 500 cycle generator self excited $35.00. English spectroscope in case $9.00. Spenser microscope three objectives including oil immersion two eyepieces Abbe condenser $85.00. Chemicals and glassware $7.00. Short wave receiving cabinet, two large condensers and pickle $20.00. Receiving cabinet, bakelite panel engraved in millihenries for inductance and microfarads for condensers, telephone plug connection $25.00. Other apparatus. Will sell or trade for scientific instruments. Want 500 volt generator. Robert Taylor, 47 Glendale Road, Upper Darby, Philadelphia.

For Sale: Complete receiving set $10. Audiotron and Holder $4, Phones 3200 Ohms $5, and other things. Vandell, 130 Butler Street, Brooklyn, N. Y.

Variable Condenser—$1.00. United Electricle Co., 38 Burns, Wyoming, Ohio.

Wanted—July, August, October and November Radio Amateur News. Quote price. E. A. Townsend, Smithville, Okla.

For Sale—Fifteen inch induction coil cabinet mounted with ammeter O-25 voltmeter O-125 Wehnelt interrupter (bad anode) can be used for X-ray, violet ray or Radio experiments, gives 500 cycles on 110 volt D. C. Siebert, 267 Radde St., Long Island City, N. Y.

For Sale—Slightly used Western Electric V.T. 1, $8.00; high school Rugby, $5. Both for $12. Want—Canoe. Harold F. Southwick, 103 Green St., Fall River, Mass.

Sell—Single barrel shot gun, 9; ½ in Spark Coil, $2.50; 2000 Ohm Murdock Receivers $4.00; 2 steel fishing rods; wire, etc. Send stamp for list. Stanley Sands, Versailles, Ohio.

For Sale—Mounted loose coupler receiving outfit. Bernard Cherzinger, 931 12th St., Hamilton, Ohio.

Sell—Two L 750 Honeycomb Coils $3.50 or exchange for 43 plate variable, Cyclopedia Applied Electricity $8.00, Murdock Antennae Series Condenser $2.00, E. I. Co. 5000 Meter Loading Coil $1.00. Daisy pump gun, 50 shot, new, $3.00. Theodor Schreyer, Ridgewood Place, Staten Island, N. Y.

For Sale—Amplifier one step $24. Two step $36. Cabinet size 6x7 inches by 6 inches deep. Acme amplifying transformers used all battery leads from back; input and output terminals on front. Siebert, 267 Radde St., Long Island City, N. Y.

For Sale—New set of ten Hawkins Electrical Guides $7. Edw. C. Schurch, 517 W. Koch St., Bozeman, Montana.

Sell—4, 7, 11 Volt Transformer $0.25. New ½ inch Spark Coil $3.25. Ross Rich, Mahanoy City, Penna.

Wanted—Omnigraph with Continental code dials. Edw. Rubenzer, Chippewa Falls, Wis. Route 8.

Slaughter—4000 Meter Cabinet Coupler $8.50. Vt-1, $6.00, new. Want Vt-2 and receptacles. Roland Place, 350 Sprague, Fall River, Mass.

For Sale: New Hawkins Guides $8.00. Other books, electrical apparatus. Send stamp for list. Byron Olney, Brevard, N. C.

Let's Swap! What've you got? Whatd'ye want? Free advertising. Three months and big mail dime. Swap Bulletin, "The National Exchange Medium." Detroit.

For Sale or Exchange: 1 micrometer, $6.00; 1 100 amp. 250 V Aerial Switch, $3.00; 1 200 Amp. 600 V Aerial Switch, $5.00; 1 10 KW transformer, $75.00; 1½ KW Rotary Spark Gap, $10.00; 1 65 ft. Aerial complete, $8.00. The following new never used. 1 20,000 meter loose coupler, $25.00; 1 cabinet audion detector, $15.00; 1 A.C. ammeter 0-60, $15.00; 1 Telephone Magneto, $3.00; 1 Crocker Wheeler Rheostat, $5.00. Write for description of each. Special discount if taken within month. No. 3 Beecher Radio Club, Beecher, Ill.

For Sale: A 40 key L. C. Smith Premier typewriter. Henry Nelson, 1241 Madison St., Eau Claire, Wis.

For Sale: Omnograph, 15 dial, new. Sell for $15. G. Bilgam, 220 East 20th St., New York City.

For Sale: Small cabinet style receiving set. Winkler, 1332 First Ave., New York City.

Exchange—Cont'd.

For Sale: Good printing press, and supplies, including $3 worth of type. Express prepaid $8. Eugene Mauer, 1624 Wis. St., Racine, Wis.

For Sale: National Radio Institute wireless course with instruments for $50.00. Regular price $65.00. Nelson Meyers, Staunton, Ill.

For Sale: Superior 2000 ohm Headset, $6.00; 2500 meter loose coupler, $7.50; One step amplifier Receiving outfit, sold separately, cheap. Send for list. "Practical Wireless Telegraphy" by Bucher, $1.50, new. Wire all sizes cheap. Henry Lehmberg, 5116 N. 12th St., Phila., Pa.

Wanted: 1 IKW Thordarson "R" transformer, good condition and reasonable price. 110 volts 60 cycles. Write Walter Leahy, Bogalusa, La.

For Sale: Rotary gap motor 6000 R.P.M. with rotor, $5.00. Cabinet type tuner, 16"x6"x6", $5.00. Raymond Logan, 217 Douglas Ave., Canon City, Colo.

Wireless Apparatus for sale. Cheap. Jurek, 2642 Ballou St., Chicago.

For Sale: ½ K. W. Transformer Coil, $7.00; Blitzen Electrolytic Interrupter, $2.00; Condenser for coil, $1.50. Used one month. Willard Hanson, 120 E. Main St., Geneva, Ohio.

Want two-step amplifier in exchange for ¾ K.W. Thordarson transformer. E. Heckenkamp, Belleville, Ill.

Sell or Exchange: Guaranteed unmounted fixed condensers to shunt across phones, etc., $.30 each. One Reliance instrument Co.'s type R Ammeter, new. Cost $12.00. Sell or trade. $7.00. One Gen. Electric Co.'s Antenna Ammeter, .0 to 1.0 amps. zero adj., $4.50. Six Bronze Arc-light movements worth $10.00, new, $3.00. Want transmitting App. Write at once. Merlin F. Harrod, New London, Ohio.

Wanted to buy 2" or 3" Spark Coil. Geo. F. Howell, Pasadena, California.

Sell—Dubiler Transmitting Condenser. .004 mfds. Working voltage 12500. Never used. Sell cheap. Write G. Garrison, East Orange, New Jersey.

For Sale: 1½ inch coil wireless set. Write for list of parts. Walter F. Forboich, Antioch, Ill. Lake County.

Sell—Tesla coil used up to ½ K. W., $4.00. 4 inch geissler tube, $.40—7 inch, $.60. Automobile drawings, $.25 and $.30. 4 Aeroplane drawings, $.20 each. Telegraph key, $1.00. Electrical Experimenters, 1918-1919 copies, $.30 each. Raymond Fiedler, 70 Sargent Street, Lawrence, Mass.

For Sale: New "K D" and Porter No. 4. 6 volt motors $7 each. Want audion and copper stranded aerial. Everett Fitzberg, 727 Washington Street, Northeast, Minneapolis, Minnesota.

For Sale: A few audio frequency amplifying transformers at $4.00 each. Prepaid. Audion panels made to order $6.00 to $10.00. Hoke & Risher, Box 34, Carlisle, Indiana.

Bargain—Complete Receiving Outfit—2000 Meter Navy Coupler Galena Detector—Murdock Condenser and Phones—$15.00. $9.00 Lietz Drawing Instruments—$6.00. Albert B. Fuller, 238 South Goodman St., Rochester, New York.

Specially tested Galena 25c piece, 3 for 50c. Apparatus for sale and made to order. Reasonable. List for stamp. Clarence Evans, Nutley, N. J.

Want to buy number of second hand card filing cabinets. Mail full description to G. Garrison, East Orange, New Jersey.

For Sale: One Murdock oscillation transformer, $2.50. One set of Victor Marconi Wireless Records, $4.00. Both articles new. Allan Collingwood, 5900 McCallum St., Germantown, Phila., Pa.

For Sale: Oil Condenser, Dubilier Mica Condenser, 2 Rotary Gap Motors. 1 in. Spark Coil, Oudin High Frequency Coil, Telegraph Keys, Relay, Sounder Medical Coil, Test Set Telephones. See Jack Baxter, 1548 Robinwood Ave., Lakewood, Ohio.

Wanted. Telegraph recorder, Vibroplex telegraph key and a 1 K. W. Thordarson new type Wireless transformer. Lawrence Black, 1835 "E" St., Lincoln, Nebr.

For Sale. "Traco" loose coupler $15.00. New De Forest panel Honeycomb mounting, $7.00. A. W. Broun, 228 Jefferson St., Rochester, Penna.

For Sale, castings of a Umakem 8" engine lathe, cost $25, sell $18. Audiotron cabinet with arc and spark switches. Write for details. George Kostka, 2347 So. Ridgeway Ave., Chicago.

For Sale. Complete Regenerative Audion detector and one step amplifier. For particulars see Philip Morse, 1240 Andrews Ave., Lakewood, Ohio.

For Sale. 2000 Meter loose coupler, Weather proof Detector, Loading Coil. Stoping Condenser, .0005 Mfd. Variable Condenser. All for $10.00. Write H. J. Becker, 3405 Itaska Street, St. Louis, Mo.

A Bargain—Long wave regenerative receptor. Cost $50 to make. Hears everything within 5000 miles using only one bulb. Panel—15" x 20", Cabinet—16" deep, Range—2500 to 18000 meters. Sell $30. Also $23 Omnigraph (15 plate). Two sets of plates, one Morse, one Continental, sell $10. Edison Standard Phonograph (cylinder) sell $8. 150 ohm relay, sell $2. All in good condition. Will pay $1.50 each for burnt out VT-1's. F. Blethem, Houlton, Maine.

Exchange—Cont'd.

Wanted: Tubular Mercury Vapor Lamp complete to operate on 110 volts D.C., and draw about 3.5 amperes. W. G. Mayer, Apt. 703, 225 W. 86th St., New York City.

Cheap for quick sale. Audiotron cabinet, new bulb and batt. $8.00. 4000 meter navy type coupler $8.00. Audiotron or Audion 2-Step amplifier without bulbs or batteries. With De-Forest Honeycomb coil mounting. Three variable condensers. $65.00. Photos sent on request. H. Peacock, 58 Rodney, Buffalo, N. Y.

For Sale: Am going to college, must sell, De-Forest Unit Panel type apparatus, Case, Honeycomb coils, Audion Bulbs, B-Batteries, phones, switches, etc. Also Professional Moving Picture Machine. List free. Write, Quick, "Make it Snappy." Atley Maurek, P. O. Box 157, Austin, Minn.

For Sale: 2000 ohm Brandes Phones $4.50, Radison Detector $3.50, large loading coil $3.00, key $1.00, new 5 bar magneto $3.00, 70 Chemicals $7.00, Set Hawkins Guides $8.00, other wireless apparatus. Write Peter Jasko, Freehold, New Jersey.

For Sale: Practically new audiotron, $3.00; No. 9 K and D Generator, $5.00; Two 45-plate Tresco Condensors, each $2.50; New $5.00 telegraph set, $3.50; Thirty S.P.S.T. switches, $1.00. Bernard Silberstein, 2328 East Third Street, Duluth, Minnesota

Wanted to Buy.

It is like finding money when you mail us old or broken watches, false teeth, brooches, bracelets, or old or broken jewelry, old gold, silver, platinum, diamonds, magneto points, platinum wire, contact points or crucibles, mercury, and anything valuable. We pay the highest prices in cash by return mail. Goods returned in ten days if you're not satisfied. The Ohio Smelting & Refining Company, 207 Lennox Bldg., Cleveland, Ohio.

Electrical Supplies and Appliances.

Full line of bells, buzzers, push-buttons, bell wire, batteries and a few other electrical supplies. Price list free on request. Edwin Davault, P. O. Box 1090, Baltimore, Md.

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Experimental Electricity Course in 20 Lessons. By S. Gernsback and H. W. Secor, E. E. A course of the theory and practice of electricity for the experimenter. Every phase of experimental electricity is treated comprehensively in plain English. New Experiments are described and explained and nearly every application of electricity in modern life is given. 160 pages—400 illustrations. Flexible cloth cover, 75c. postpaid. Stiff cloth cover, $1.25 postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton Street, New York.

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Amateurs Attention—Loose Couplers from 800—15,000 meters, $4—$20. Tubes wound to specification. N. A. Radio Equip. Co., 510 Claremont Parkway, Bronx, N. Y.

Spark Coil, 20x9 inches. Contains 100 miles of wire. Weighs with condenser, 16x30x3 in. about 100 lbs. Heavy table 36x18x32 high, $25. D. T. Marshall, Hollis, N. Y.

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Special, for a short time only. Single slide tuning coils, cheap. Send stamp for particulars. Act quick. G. L. Wireless Supply Company, Arlington Heights, Illinois.

Thirty Dollars Complete receiving Outfit, cabinet design; loose-coupler, two loading coils, variable and fixed condenser, audion receptacle, rheostat, amplifying coil, grid leak. Frey, 208 Freeman Ave., Jersey City.

Bargains—Clapp-Eastham type H. receiving transformer $6.00. Murdock Variable condenser $2.50, Western Union type telegraph instruments. Write for list. Arthur Egan, 6 Whiting Ave., Holyoke, Mass.

Hey Bugs get our price list. All best kinds of apparatus cheap. Relay for list to 90c or write Amateur Builders' Supply Labs., 1315 E. High St., Davenport, Iowa.

"Silverplate" without electricity. Make your apparatus efficient, modern and commercial looking. One botle of "Silverplate" plates your complete set. Just "rub" it on. 35c per bottle. Roberts Laboratory, 11718 Detroit Ave., Cleveland, Ohio.

For Sale: High grade ¼ K.W. transmitting set. Sell separate. Arthur Haake, West Norwood, New Jersey.

Just off the Press. Design and Construction of Audion Amplifying Transformers (Radio and Audio-Frequency Types). By Edward T. Jones, late Associate Editor Radio Amateur News. The transformers shown in this book have never been described in print before and have usually been considered a manufacturer's secret. The designs are very rugged and simple. A book that every radio "bug" should have. Written so you will understand every word. Price 25c postpaid. Experimenter Publishing Co., Book Dept., 231-A Fulton Street, New York City.

How to Make Wireless Receiving Apparatus. 100 pages—90 illustrations. Only strictly modern radio apparatus are described in this book and the illustrations and descriptions are so clear and simple that no trouble will be experienced in making the instruments. Paper covered, 25c postpaid. Experimenter Publishing Co., Book Dept., 233 Fulton St., New York City.

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(*Continued on page* 598)

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EVEN THE NEWSPAPERS ARE GETTING THE FEVER

Perhaps some of you do not know that several newspapers in various sections of the United States are conducting a regular radio department where they publish radio articles and other interesting information to be literally devoured by the ever increasing hordes of amateurs.

The *Cleveland Press* recently made an announcement of a radio contest in which the total number of prizes equals $1,234.

THE EVENTS.

Prizes in the contest total $1,234. Prizes totaling $1,084 will be awarded in three events. Competition in these is national.

In addition the *Press* will award a $150 wireless receiving apparatus locally in the first event. Only entries made directly with the *Press* will be considered for the prize.

The receiving apparatus was on exhibition at the Electric Show held at Cleveland recently.

FIRST EVENT.

The best 500 word essay on amateur wireless telegraphy. General interest and literary value of essays will be considered. Contestants must own whole or part of a wireless outfit or must be members of an amateur radio club.

Prizes: First, $200; second, $100; third, $50. Thirty additional prizes—each a pair of radio receivers, retail value $7. Also a $150 wireless receiving apparatus to be awarded to the best entry made with the *Cleveland Press.*

SECOND EVENT.

The best photographs of amateur radio stations together with a 200-word description. Value of the sets from standpoint of neatness, originality, efficiency and choice of instruments as shown by photo and description will be considered.

Prizes: First, $100; second, $50. Sixteen additional prizes—each a pair of radio receivers, retail value $7.

THIRD EVENT.

Best long distance receiving record made by amateur with amateur outfit. Record must be made before one witness and sworn to before notary public. Entry blank publisht in Thursday's *Press* or a typewritten copy should be used.

Prizes: First, $100; second, $50. Sixteen additional prizes—each a pair of radio receivers, retail value $7.

RULES OF THE CONTEST.

1. Contest open to owner or part owner of an amateur radio station or any member of an amateur radio club which owns a station.
2. Manuscripts must be neatly written in ink or typewritten on one side of the paper only. Neither manuscripts nor photos can be returned.
3. Contestants may enter one, two or three events.
4. Contest closed March 31.
5. All entries were addrest to the Wireless Editor of the *Cleveland Press.*

CORRECTION NOTICE.

There appeared in the February issue of RADIO AMATEUR NEWS, on page 407, an article entitled, "Use of the Vacuum Tube for Sustaining Mechanical Oscillations." Unfortunately the authors' names as well as the source from which the article was abstracted were overlooked and not printed. This article as well as a rather complete treatise on radio telegraphy may be found in that excellent book, "Radio Engineering Principles," by Messrs. Henri Lauer, B.S., and Harry L. Brown, B.E.E., a volume publisht by the McGraw Hill Book Co., Inc.

(*Continued from page* 597)

Phonographs.

Build Phonographs—Reliable Dayton Motors, Tone Arms, Hardware & Accessories. Illustrated Catalogue for two-cent stamp. Sam R. Kremer, 118 Court Ave., Dayton, Ohio.

Patriotic Novelties.

A. E. F. Pillows and Pennants, honor rolls. Dept. E, Military Supply, Aurora, Ill.

Rubber Stamps.

Rubber Stamps made to order, McCaddon Company, Zanesville, Ohio.

Mailing Lists.

Newly compiled lists of Ex-service men, $3.50, thousand. Dept. E, Victory Military Supply, Aurora, Ill.

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Free—One old coin with my 10c coin book. Durso, Dept. 50, 25 Mulberry, New York City.

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Stamps—12 different from warring nations, 10c. 10 different foreign coins, 25c; 10 Uruguay stamps for 10c. Lists free. Toledo Stamp Company, Toledo, Ohio.

Stamps 50c. Catalogue value, 15c. Particulars and Approvals. Stampcraft, Hanford, Calif.

100 Different Stamps, 12c; 200, 27c. Michaels, 5600 Prairie, Chicago.

200 all different stamps, including Bosnia, Bavaria, China, Guatemala, Bulgaria, Bohemia, Poland, Turkey, etc., and Dime Stamp Album, only one to a customer, all for 25c. Our approval sheets contain Bargains priced at 1c to 5c Net. 150 different U. S. Postage and Civil War Revenues for only 75c. Indiana Stamp Co., Dept. E, Indianapolis, Ind.

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Have you seen The Stamp Herald? Finest monthly stamp paper published. Subscription 50c a year, 3 months' trial for 10c. Stamp Herald Publishing Co., Dept. E., Indianapolis, Ind.

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Typewriters.

Typewriter Ribbons, all typewriters, 50c. Abolt Typewriter Company, 38 East 23rd St., New York.

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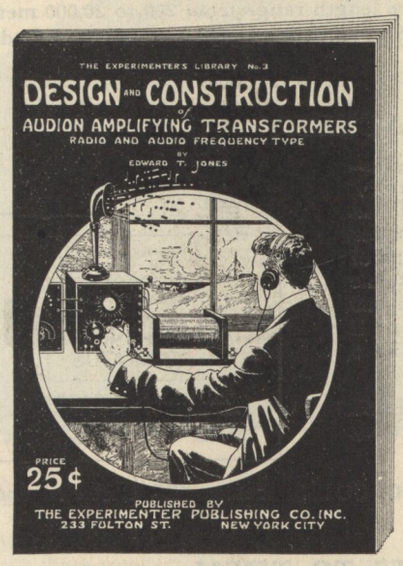

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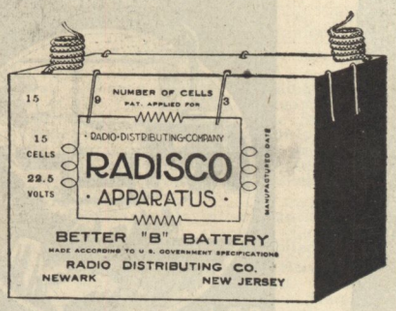

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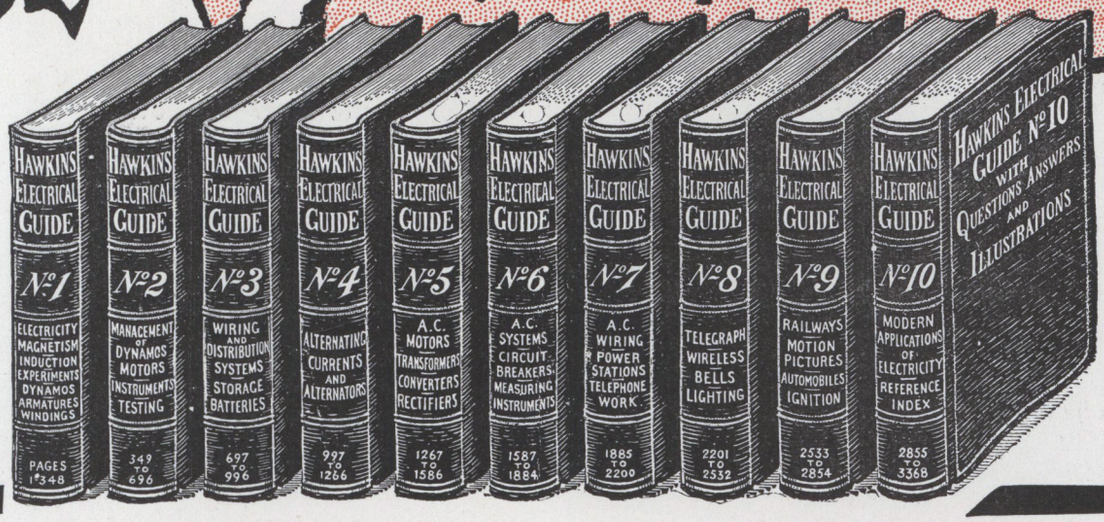
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